United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Camden County, Missouri

How To Use This Soil Survey

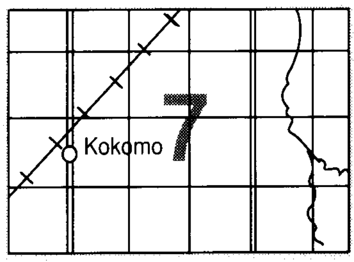
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

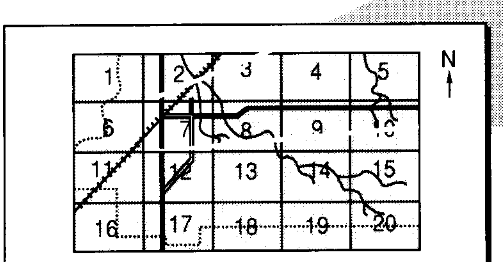
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



MAP SHEET

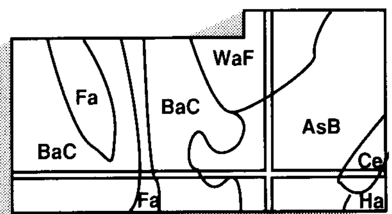
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.

MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1988. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork. The County Commission and the Missouri Department of Natural Resources provided the Camden County Soil and Water Conservation District with funds for the temporary employment of additional soil scientists. The survey is part of the technical assistance furnished to the Camden County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: An area of the Niangua-Bardley association is adjacent to the Lake of the Ozarks. Recreation, tourism, and lakeside development are essential to the economic vitality of Camden County.

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Foreword

This soil survey contains information that can be used in land-planning programs in Camden County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow over bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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Soil Survey of Camden County, Missouri

By David W. Wolf, Soil Conservation Service

Fieldwork by David W. Wolf, Soil Conservation Service, and Duane E. Viele, Missouri Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Missouri Agricultural Experiment Station

CAMDEN COUNTY is in the south-central part of Missouri (fig. 1). It has a total area of about 708 square miles, or 453,216 acres, of which about 67 square miles, or 42,944 acres, is water. Camdenton, the county seat, is in the south-central part of the county. In 1980, the population of Camden County was 20,017 and the population of Camdenton was 2,303 *(6)*.

Beef cattle, dairy cattle, and hogs are raised in the county. Cool-season grasses and shallow-rooted legumes, such as tall fescue and red clover, are the main forage crops grown for pasture and hay. Only a very small acreage of row crops is grown in the county. Most of the pasture and hayland is in gently sloping and moderately sloping areas in the uplands and in areas of soils on bottom land. The deeply dissected uplands support most of the woodland in the county.

The survey area is dominantly rural, but much of the land is used for nonagricultural purposes. Nearly 60 percent of the farmers in Camden County report their principal occupation as something other than farming *(12)*.

A major portion of the Lake of the Ozarks is in Camden County. The lake is a major tourist attraction and retirement area and contributes significantly to the economy of the county. The area around the Lake of the Ozarks has developed rapidly in recent years. This development has contributed to the increased construction of dwellings and new businesses and to the expansion of existing businesses.

Soil scientists have identified 21 different kinds of soil in the survey area. The soils range widely in texture, natural drainage, depth to bedrock, and other characteristics. Most soils in the uplands formed in cherty limestone residuum or in a thin mantle of loess and the underlying cherty limestone residuum.

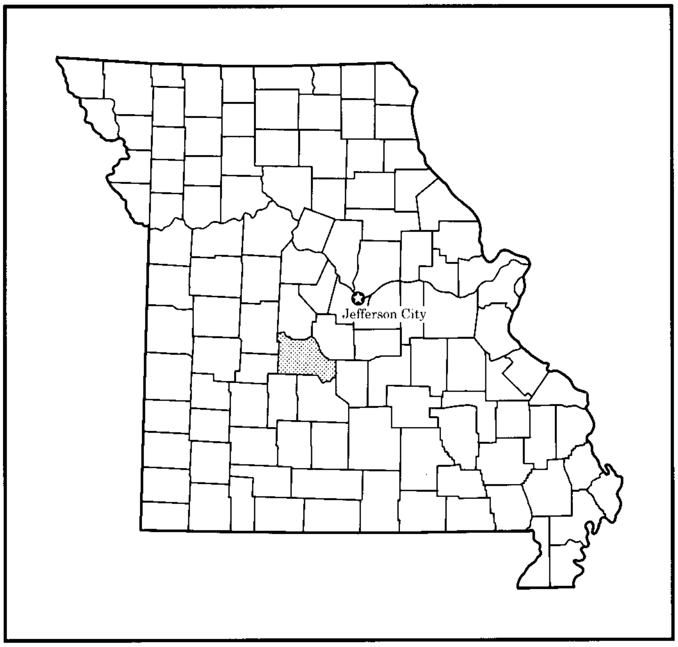

Figure 1.—Location of Camden County in Missouri.

General Nature of the County

This section provides general information about Camden County. It describes climate and history and development.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Camdenton in the period 1951 to 1987. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 35 degrees F and the average daily minimum temperature is 24 degrees. The lowest temperature on record, which occurred at Camdenton on December 25, 1983, is -20 degrees. In summer, the average temperature is 77 degrees and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 115 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 42.32 inches. Of this, 25 inches, or about 59 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 4.67 inches at Camdenton on October 13, 1968. Thunderstorms occur on about 53 days each year.

The average seasonal snowfall is about 19 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 12 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally, but they are local in extent and of short duration. They may cause damage in scattered areas. The amount of damage varies. Hailstorms sometimes occur in scattered small areas during the warmer part of the year.

History and Development

Osage and Delaware Indians once inhabited the territory now known as Camden County. They built their villages on the terraces along major streams, where they hunted, fished, and raised corn, beans, and pumpkins. In 1827, white settlers began moving into the area after the Indians signed a treaty ceding the land to the U.S. Government *(3)*. For many years after the treaty was signed, the Indians continued to hunt in the area. They camped at various places and hunted deer, bears, turkeys, and raccoons and other small game. They preserved the meat by drying it on scaffolds over fires. After 1846, they no longer returned to the area as a group *(3)*.

Ruben Berry and William Pogue were among the earliest permanent white settlers in the survey area. When they arrived in 1827, they discovered the hull of a keelboat submerged in the Osage River *(3)*. Also, a wooden fur press was found at the mouth of Linn Creek. These artifacts were evidence that French or Spanish explorers, hunters, and trappers had also been in the area. Other settlers later came to the area from Kentucky, Tennessee, and Virginia *(8)*.

Kinderhook County, which is now known as Camden County, was organized in accordance with an act of the Legislature and approved by Governor Thomas Reynolds on January 20, 1841 *(3)*. A site was selected for the county seat on April 12, 1841, in the town of Oregon. The county name was changed to Camden County by an act of the General Assembly of Missouri on February 23, 1843, and the name of the county seat was changed from Oregon to Erie. In 1850, the county seat was moved from Erie to Linn Creek *(3)*. When Linn Creek was inundated by the creation of the Lake of the Ozarks, the county seat was moved to its present location at Camdenton.

Because of the cherty soils, limited transportation facilities, distant markets, and hilly, forested topography, the agricultural enterprises of the area were generally limited to part-time livestock farming. Timber was harvested mostly for railroad ties, fuel, and building material. Other occupations centered around hunting and fishing and the handcrafting of necessities for subsistence. Some row crops were grown in small areas on the stream terraces and flood plains and were used as livestock feed. After World War II, the livestock economy was based on the production of unfinished feeder cattle *(5)*. Higher cattle prices in the 1960's and 1970's made the conversion of timberland to pasture profitable.

Although the area was generally unsuited to agricultural enterprise, many people from Kansas City, St. Louis, and Chicago were attracted to the area's scenic hills and rivers. In order to expand the recreational potential of the area, construction of Bagnell Dam began on August 6, 1929 *(4)*. The Lake of the Ozarks began to fill on February 2, 1931, and the area was opened to the public in May of that year. Camdenton and the new Linn Creek were created for the relocation of families living in the area flooded by the lake. The stock market crash that heralded the Great Depression took place four months after construction of the dam began. While the rest of the country was affected by the Depression, the Bagnell project brought about a growth and expansion in mid-Missouri that continues today. Land development for recreational resorts and associated operations and for businesses and homes continues to be the major economical enterprise of the area.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they

drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey do not fully agree with those in the surveys of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

1. Niangua-Bardley Association

Deep and moderately deep, well drained, moderately sloping to very steep, very cherty, silty soils; on uplands

The landscape is characterized by prominent relief. Side slopes separate nose slopes and irregularly shaped low ridgetops. Numerous short drainageways are notched into the side slopes. Drainageways merge and become creeks that flow through narrow flood plains (fig. 2). Stones cover as much as 3 percent of the surface. Short, rocky bluffs and ledges crop out in many places, especially on south- and west-facing slopes. Slopes range from 14 to 50 percent.

This association makes up about 41 percent of the county. It is about 45 percent Niangua soils, 35 percent Bardley soils, and 20 percent minor soils.

Niangua soils are on moderately steep and steep side slopes. Typically, the surface layer is black very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The subsoil is red, mottled cherty silty clay and clay in the upper part and yellowish brown, mottled cherty clay in the lower part. At a depth of about 52 inches, a 3-inch chert bed is just above dolomite bedrock.

Bardley soils are on the moderately sloping to very steep lower side slopes, benches, and nose slopes. Typically, the surface layer is dark brown very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The subsoil is red cherty clay and clay in the upper part and yellowish red cherty clay in the lower part. Hard dolomite bedrock is at a depth of about 28 inches.

Minor in this association are Cedargap and Doniphan soils and the somewhat excessively drained Gasconade soils. Cedargap soils have less clay than the major soils. They are on narrow flood plains. Doniphan soils are more than 60 inches deep over bedrock. They are on high, narrow ridgetops. Gasconade soils are less than 20 inches deep over bedrock. They are on nose slopes, on low, narrow ridges, and in glade areas, generally on south- and west-facing slopes.

Most of the rough, steep areas of this association support mixed oak and hickory woodland. Some of the small creek bottoms are cleared for pastures or gardens. Most of the roads are on or parallel to the narrow ridges. A few homes are on ridgetops or foot slopes along the creeks. Near the Lake of the Ozarks, however, building site development and sanitary facilities are the dominant land uses.

The soils in this association are suited to trees. Most areas support second-growth black oak and post oak. Small areas of white oak are on north- and east-facing slopes. The hazard of erosion, the equipment limitation, and seedling mortality are management concerns. The windthrow hazard is a management concern on the Bardley soils.

This association generally is unsuited to building site development and sanitary facilities. In areas around the Lake of the Ozarks, however, it is being used extensively for these purposes. The slope, the shrink-swell potential, and the depth to bedrock are

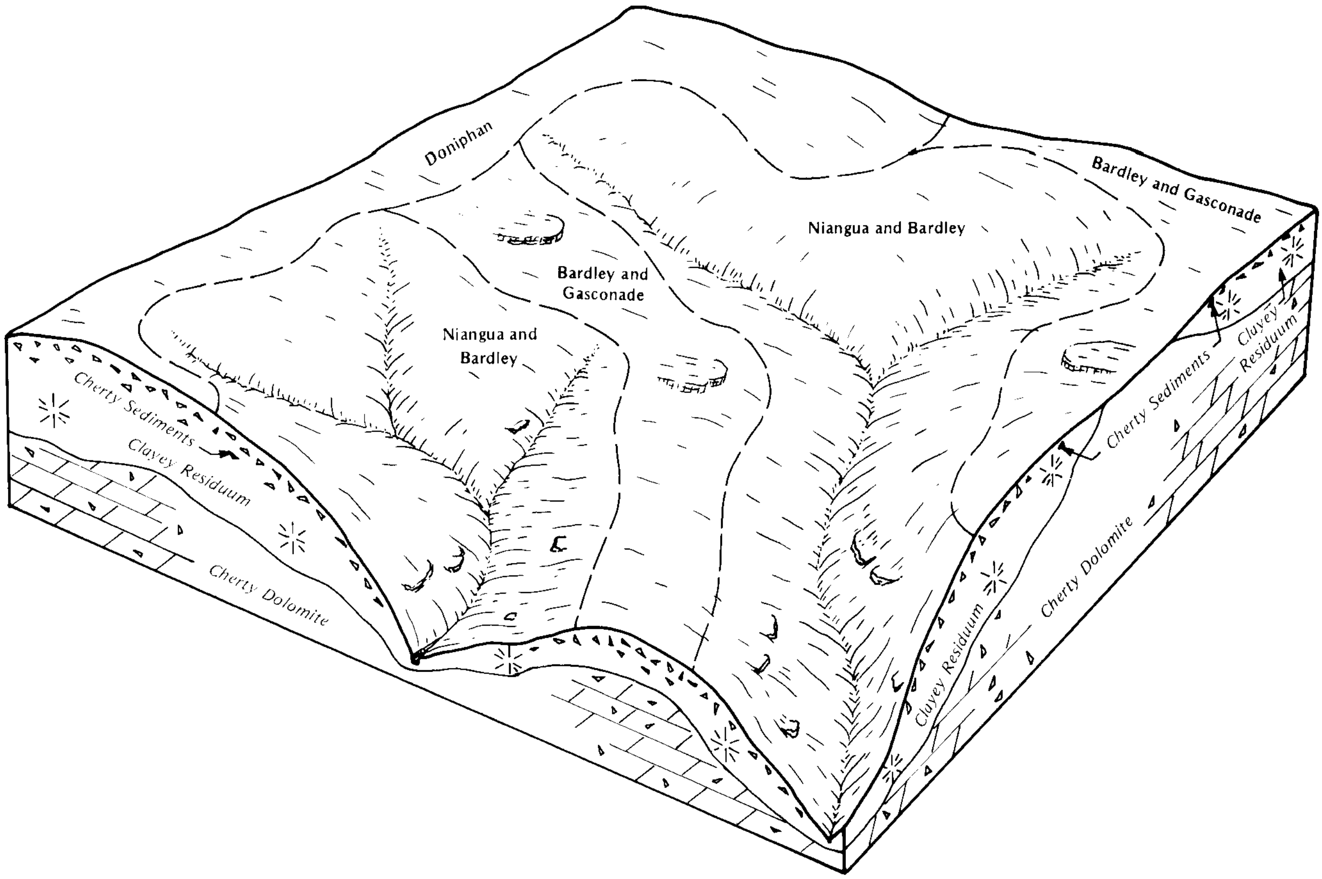

Figure 2.—Typical pattern of soils and parent material in the Niangua-Bardley association.

management concerns. Seepage is a management concern in areas of the Bardley soils. Permeability is a management concern in areas of the Niangua soils.

2. Clarksville-Doniphan-Gepp Association

Very deep, somewhat excessively drained and well drained, gently sloping to steep, very cherty, silty soils; on uplands

This association consists of soils on uneven side slopes, narrow ridgetops and shoulder slopes, and head slopes and nose slopes in the upper reaches of large drainage areas (fig. 3). Stones cover less than 0.1 percent of the surface. Slopes range from 3 to 35 percent.

This association makes up about 25 percent of the county. It is about 38 percent Clarksville soils, 30 percent Doniphan soils, 17 percent Gepp soils, and 15 percent minor soils.

Clarksville soils are somewhat excessively drained and are on strongly sloping to steep head slopes and the upper side slopes. Typically, the surface layer is dark grayish brown very cherty silt loam. The subsurface layer is light yellowish brown very cherty silt loam. The upper part of the subsoil is strong brown, mottled extremely cherty silt loam and extremely cherty silty clay loam. The next part is strong brown and yellowish red very cherty silty clay loam. The lower part is red, mottled very cherty silty clay.

Doniphan soils are well drained and are on gently sloping to moderately sloping, narrow ridgetops and shoulder slopes. Typically, the surface layer is dark grayish brown very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The upper part of the subsoil is strong brown cherty silty clay loam mixed with material from the surface layer. The next part is strong brown or dark red, mottled silty clay or clay. The lower part is mottled dark red, strong brown, and light brownish gray extremely cherty clay.

Gepp soils are well drained and are on the lower parts of moderately steep and steep side slopes.

Typically, the surface layer is brown very cherty silt loam. The subsurface layer is light yellowish brown very cherty silt loam. The upper part of the subsoil is yellowish red, mottled cherty silty clay loam. The lower part is dark red, mottled clay and cherty clay.

Minor in this association are Bardley and Cedargap soils, the moderately well drained Lebanon soils, and Niangua soils. Bardley soils are 20 to 40 inches deep over bedrock. They are on nose slopes and on benches on side slopes. Cedargap soils have less clay than the major soils. They are on small, narrow flood plains. Lebanon soils have a fragipan. They are on the broader parts of ridgetops. Niangua soils are 40 to 60 inches deep over bedrock. They are on side slopes.

Most areas of this association support native stands of black oak, red oak, and post oak and some hickory and white oak. A few small areas, generally on narrow ridgetops or on flood plains along small creeks, have been cleared for pasture.

The soils in this association are suited to trees. The best sites for timber are on the lower part of north- and east-facing slopes. The hazard of erosion, the equipment limitation, and seedling mortality are the main management concerns.

In easily accessible areas, grasses and legumes can be used for pasture. Pastures can be difficult to establish and maintain. Droughtiness, the hazard of erosion, and the cherty fragments in the surface layer are the main management concerns.

This association is unsuited to cultivated crops because of the moderately steep and steep slopes and the high content of chert in the surface layer.

This association generally is unsuited to building site development and sanitary facilities. In areas around the Lake of the Ozarks, however, it is being used extensively for these purposes. The slope and seepage are management concerns in areas of the Clarksville soils. Restricted permeability, large stones, and the shrink-swell potential are management concerns in areas of the Doniphan soils. The slope, seepage, restricted permeability, and the shrink-swell potential are management concerns in areas of the Gepp soils.

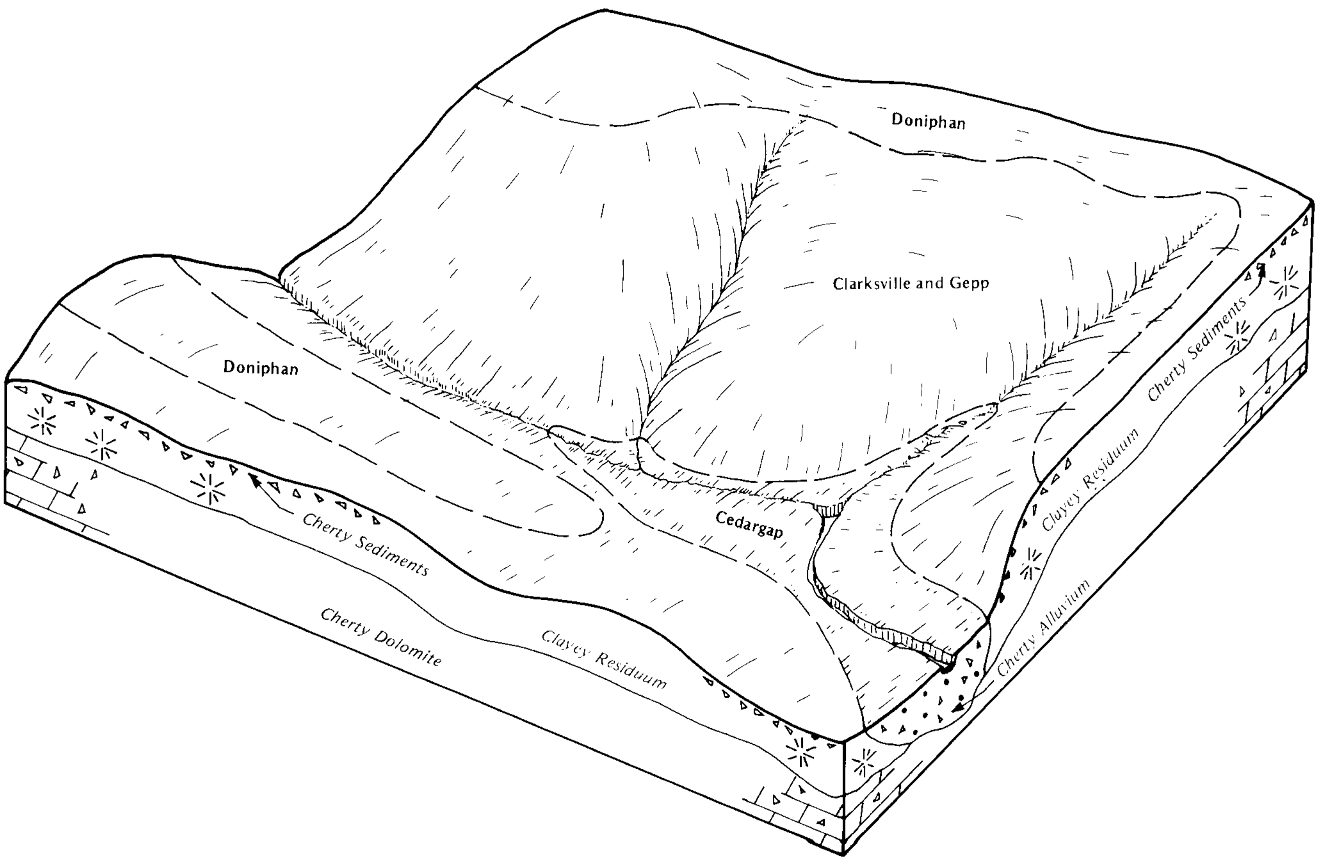

Figure 3.—Typical pattern of soils and parent material in the Clarksville-Doniphan-Gepp association.

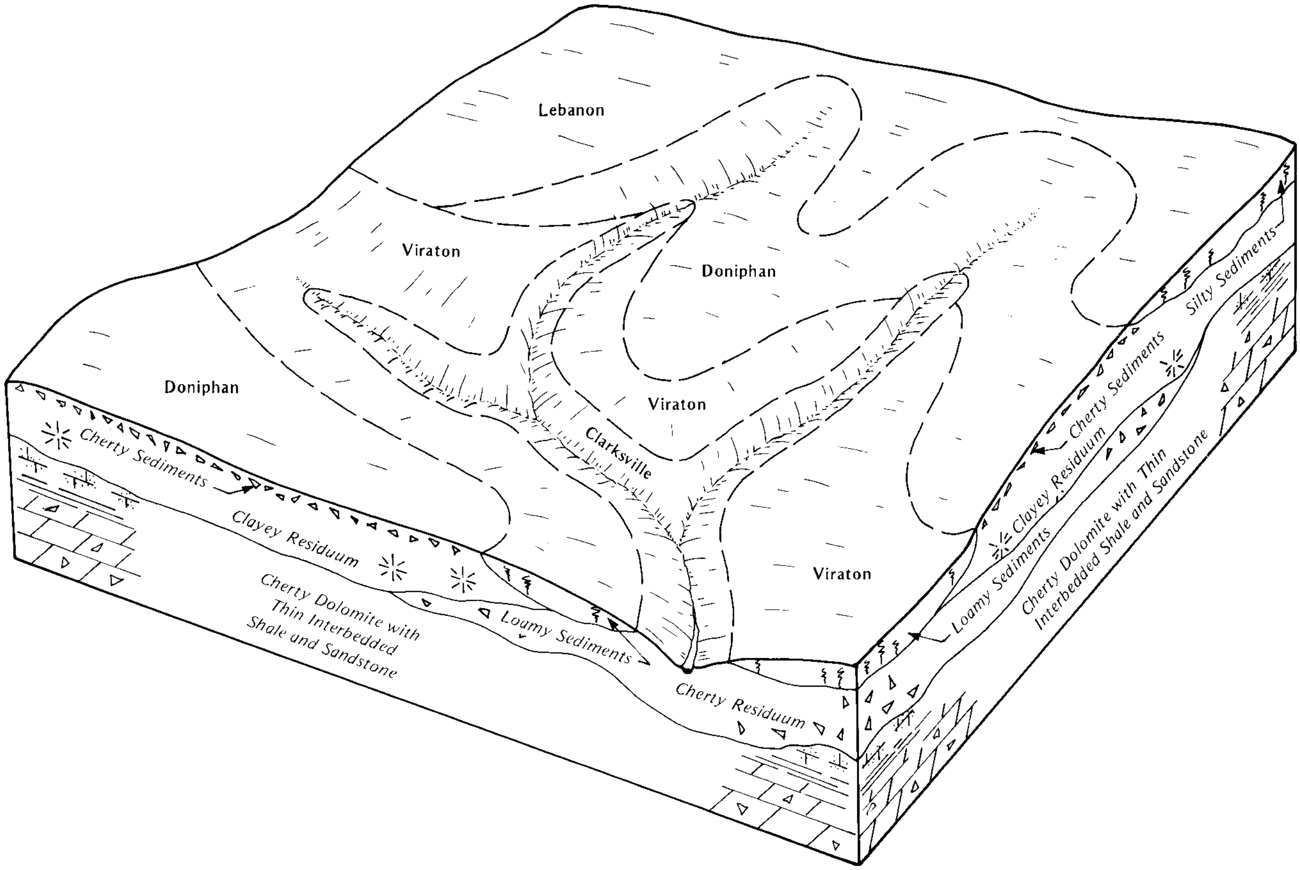

Figure 4.—Typical pattern of soils and parent material in the Doniphan-Lebanon-Viraton association.

3. Doniphan-Lebanon-Viraton Association

Very deep, well drained and moderately well drained, gently sloping and moderately sloping, silty soils and very cherty, silty soils; on uplands

This association consists of soils on wide or narrow ridgetops that make up the major divides between the main rivers and streams of the survey area (fig. 4). Slopes range from 2 to 9 percent.

This association makes up about 19 percent of the county. It is about 37 percent Doniphan soils, 28 percent Lebanon soils, 18 percent Viraton soils, and 17 percent minor soils.

Doniphan soils are well drained and are on gently sloping and moderately sloping narrow ridgetops and shoulder slopes. Typically, the surface layer is dark grayish brown very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The upper part of the subsoil is strong brown cherty silty clay loam mixed with material from the subsurface layer. The next part is strong brown or dark red, mottled silty clay or clay. The lower part is mottled extremely cherty clay.

Lebanon soils are moderately well drained and are on the wider gently sloping ridgetops. Typically, the surface layer is dark brown silt loam. The upper part of the subsoil is strong brown silty clay loam and silty clay and grayish brown, mottled silty clay. Below this is a fragipan of light brownish gray, mottled extremely cherty silt loam. The lower part of the subsoil is reddish brown and dark reddish brown, mottled very cherty clay and cherty clay.

Viraton soils are moderately well drained and are on gently sloping and moderately sloping ridgetops and shoulder slopes. Typically, the surface layer is dark brown silt loam. The upper part of the subsoil is yellowish brown, mottled silty clay loam; strong brown,

mottled cherty silty clay loam; and pale brown, mottled cherty silty clay loam. Below this is a fragipan of light brownish gray, mottled extremely cherty silt loam. The lower part of the subsoil is dark red and red, mottled cherty clay and clay.

Minor in this association are Cedargap soils, the somewhat excessively drained Clarksville soils, and Gatewood soils. Cedargap soils are cherty throughout. They are on small, narrow flood plains. Clarksville soils have less clay and more chert than the major soils. They are on steep side slopes below the ridgetops. Gatewood soils are 20 to 40 inches deep over bedrock. They are on high knobs or in low saddles on the ridgetops.

Most areas of this association support grasses and legumes for pasture and hay. Some areas are wooded. Generally, the wide ridges have been cleared but the narrow ridges remain wooded.

The soils in this association are suited to grasses and legumes for pasture and hay. The Lebanon and Viraton soils are best suited to shallow-rooted legumes because of the limited rooting depth above the fragipan. Droughtiness, the chert fragments in the surface layer of the Doniphan soils, and the hazard of erosion on the Lebanon and Viraton soils are management concerns during the establishment of new seedlings.

The soils in this association are suited to trees. The equipment limitation is a management concern on the Doniphan soils. The windthrow hazard is a management concern in areas of the Lebanon and Viraton soils. Seedling mortality is an additional concern in areas of the Viraton soils.

The Lebanon and Viraton soils generally are suited to cultivated crops. The most commonly grown crops are grain sorghum and small grain. In areas of the Lebanon and Viraton soils, erosion is a hazard and insufficient soil moisture in midsummer is often a limitation. Spring planting may be delayed, however, because of seasonal wetness. The Doniphan soils generally are unsuitable for cultivated crops because of the chert fragments in the surface layer and the droughtiness.

This association generally is suitable for building site development and sanitary facilities. The slope, the seasonal wetness, and restricted permeability are management concerns in areas of the Lebanon and Viraton soils. Seepage and large stones are limitations affecting the construction of sanitary facilities on the Doniphan soils. Permeability and the shrink-swell potential also are management concerns in areas of the Doniphan soils.

4. Gatewood-Doniphan-Gunlock Association

Moderately deep and very deep, moderately well drained and well drained, gently sloping to strongly sloping, silty soils and cherty and very cherty, silty soils; on uplands, foot slopes, and terraces

The landscape is characterized by side slopes that grade smoothly into higher, narrow ridges and long, gently sloping foot slopes (fig. 5). Slopes range from 3 to 14 percent.

This association makes up about 9 percent of the county. It is about 52 percent Gatewood soils, 13 percent Doniphan and similar soils, 11 percent Gunlock soils, and 24 percent minor soils.

Gatewood soils are moderately well drained and are on moderately sloping ridgetops, on nose slopes, and on strongly sloping side slopes. Typically, the surface layer is dark brown cherty silt loam. The subsurface layer is yellowish brown cherty silt loam. The subsoil is strong brown and yellowish brown, mottled clay. The substratum is yellowish brown clay. Hard dolomite bedrock is at a depth of about 38 inches.

Doniphan soils are well drained and are on narrow, gently sloping and moderately sloping ridgetops. Typically, the surface layer is dark grayish brown very cherty silt loam. The subsurface layer is pale brown very cherty silt loam. The upper part of the subsoil is strong brown cherty silty clay loam mixed with material from the subsurface layer. The next part is strong brown or dark red, mottled silty clay or clay. The lower part is mottled dark red, strong brown, and light brownish gray extremely cherty clay.

Gunlock soils are moderately well drained and are on the lower gently sloping and moderately sloping side slopes, foot slopes, and terraces. Typically, the surface layer is very dark grayish brown silt loam. The subsurface layer is dark brown silt loam. The upper part of the subsoil is brown and strong brown, mottled silty clay loam. The next part is a somewhat brittle layer of yellowish brown and grayish brown, mottled silty clay loam. The lower part is dark yellowish brown and strong brown, mottled silty clay and cherty clay.

Minor in this association are Cedargap soils, the somewhat excessively drained Gasconade soils, and Lebanon and Razort soils. Cedargap soils have more chert and less clay throughout the subsoil than the major soils. They are on narrow flood plains. Gasconade soils are less than 20 inches deep over bedrock. They are on nose slopes, ridgetop knolls, and side slopes in glade areas, generally on south- and west-facing slopes. Lebanon soils have a fragipan. They are on the broader ridgetops. Razort soils have

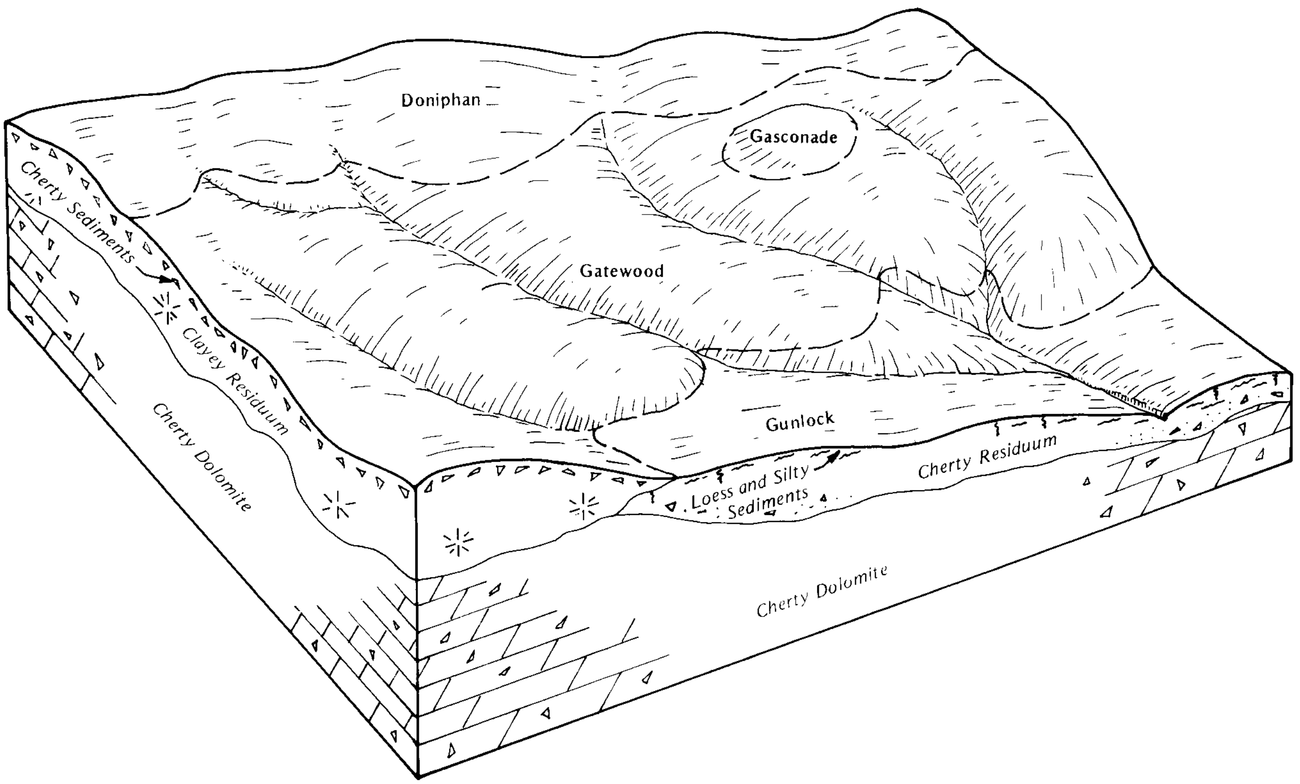

Figure 5.—Typical pattern of soils and parent material in the Gatewood-Doniphan-Gunlock association.

less clay than the major soils. They are on small stream terraces.

Most areas of this association are used as woodland or for grasses and legumes for pasture. Most areas of the Gatewood and Doniphan soils support second-growth native hardwoods. The Gunlock soils generally are used for grasses and legumes for hay and pasture.

Most of the soils in this association are suited to trees. The best sites are in areas of the Gunlock and Doniphan soils on north- and east-facing slopes and in areas of the included soils on flood plains along small streams. The equipment limitation is a management concern on the Doniphan soils.

This association generally is suited to grasses and legumes for pasture and hay. The hazard of erosion is the main management concern during seedbed preparation and during the establishment of grasses and legumes. The content of chert in the surface layer and droughtiness also are limitations in areas of the Gatewood and Doniphan soils. The Gatewood and Doniphan soils generally are unsuited to cultivated crops because of droughtiness, low fertility, and the high content of chert in the surface layer. The Gunlock soils are suited to cultivated crops. The most commonly grown crops are grain sorghum and small grain. The main management concern is the hazard of erosion.

The soils in this association generally are suited to building site development and sanitary facilities. The shrink-swell potential and restricted permeability are the major management concerns. The depth to bedrock in the Gatewood soils and wetness in the Gunlock soils also are management concerns. Seepage is a limitation on sites for septic tank absorption fields in areas of the Gatewood and Doniphan soils. Large stones in the Doniphan soils are a problem.

5. Lebanon-Plato Association

Very deep, moderately well drained and somewhat poorly drained, very gently sloping and gently sloping, silty soils; on uplands

This association consists of soils on broad, loess-covered ridgetops. These ridgetops are long and narrow or irregularly shaped. Slopes range from 1 to 5 percent.

This association makes up about 2 percent of the county. It is about 81 percent Lebanon soils, 10 percent Plato soils, and 9 percent minor soils.

Lebanon soils are moderately well drained and are in gently sloping areas on ridgetops. Typically, the surface layer is dark brown silt loam. The upper part of the

subsoil is strong brown silty clay loam and silty clay. The next part is grayish brown, mottled silty clay. Below this is a fragipan of light brownish gray extremely cherty silt loam. The lower part of the subsoil is reddish brown and dark reddish brown, mottled very cherty clay and cherty clay.

Plato soils are somewhat poorly drained and are in very gently sloping and gently sloping areas, generally near the center of ridgetops. Typically, the surface layer is dark grayish brown silt loam. The upper part of the subsoil is yellowish brown, mottled silty clay loam and yellowish brown and grayish brown, mottled silty clay. The next part is a fragipan of yellowish brown and light brownish gray cherty silty clay loam. The lower part is yellowish red, mottled cherty silty clay loam and dark red, mottled very cherty silty clay.

Minor in this association are the somewhat excessively drained Clarksville soils and the well drained Doniphan soils. These minor soils do not have a fragipan. Clarksville soils have more chert and less clay than the major soils. They are on side slopes below the ridgetops. Doniphan soils have a very cherty surface layer. They are on narrow ridgetops.

Most areas of this association support grasses and legumes for pasture and hay. A few areas are used for small grain or row crops, and some areas support second-growth hardwoods. The main farm enterprise is raising beef cattle. Most of the forage crops and cultivated crops are grown for use on the farm. Ponds generally are used for livestock watering facilities; however, seepage is a limitation. Sealing methods should be included in pond construction.

The soils in this association generally are suited to grasses and shallow-rooted legumes for pasture and hay. The hazard of erosion is the main management concern.

In areas used for cultivated crops, the hazard of erosion, seasonal wetness, and midsummer droughtiness are management concerns. The windthrow hazard is the main concern in wooded areas.

This association generally is suitable for building site development and onsite waste disposal. The seasonal wetness, restricted permeability in and below the fragipan, and the shrink-swell potential are severe limitations. The slope is a moderate limitation.

6. Nolin-Peridge-Huntington Association

Very deep, well drained, nearly level to moderately sloping, silty soils; on flood plains, terraces, and foot slopes

This association consists of soils along the Niangua River and the Little Niangua River. Individual areas have an average width of about 900 feet and are bordered by steep bluffs and strongly sloping to very steep uplands. Slopes range from 0 to 9 percent.

This association makes up about 4 percent of the county. It is about 35 percent Nolin soils, 33 percent Peridge soils, 11 percent Huntington soils, and 21 percent minor soils.

Nolin soils are in the higher areas on the flood plains. Typically, the surface layer is dark grayish brown silt loam. The subsoil is brown silt loam in the upper part and brown silty clay loam in the lower part.

Peridge soils are on terraces and foot slopes directly above the flood plains. Typically, the surface layer is dark brown silt loam. The subsoil is yellowish red silty clay loam in the upper part and yellowish red cherty silty clay loam in the lower part.

Huntington soils are in low areas on the flood plains. Typically, the surface layer is very dark grayish brown silt loam. The subsurface layer is very dark grayish brown and brown silt loam. The subsoil is brown silt loam in the upper part and brown, mottled silty clay loam in the lower part.

Minor in this association are Cedargap soils, the somewhat poorly drained Hartville soils, and the poorly drained Moniteau soils. Cedargap soils are cherty throughout. They are adjacent to active stream channels and are on alluvial fans of small streams entering the major flood plains. Hartville soils have a grayer subsoil and more clay than the major soils. They are on low foot slopes or terraces. Moniteau soils have a grayer subsurface layer than the major soils. They are on nearly level stream terraces adjacent to the uplands.

This association is used primarily for hay and pasture. Mixtures of cool-season grasses and legumes are most commonly grown. Corn, grain sorghum, and wheat are also grown. A few streambanks and other areas with limited access are wooded.

The soils in this association generally are well suited to grasses and legumes and cultivated crops. The crops respond well to soil amendments. In cultivated areas, the Peridge soils are subject to severe erosion. Flooding is a management concern on the Huntington and Nolin soils. In areas that are flooded in the spring, planting should be delayed. The suitability for irrigated crops, especially alfalfa, is good.

The Huntington and Nolin soils generally are unsuited to building site development and sanitary facilities because of the flooding. The Peridge soils generally are suited to these uses. The slope, restricted permeability, and seepage are the main management concerns.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Peridge silt loam, 2 to 5 percent slopes, is a phase of the Peridge series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Bardley-Gasconade complex, 5 to 14 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Riverwash is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

11D—Bardley-Gasconade complex, 5 to 14 percent slopes. This complex consists of moderately deep and shallow, moderately sloping and strongly sloping, well drained and somewhat excessively drained soils on narrow, uneven ridgetops and nose slopes in the uplands. It generally is about 65 percent Bardley soil and 25 percent Gasconade soil. The Bardley soil is in the more even, less sloping areas of the ridgetops. The Gasconade soil is in the steeper areas and on knobs, shoulder slopes, and nose slopes of the ridgetops. Individual areas are irregular in shape or linear and range from about 5 to 40 acres in size.

Typically, the surface layer of the Bardley soil is dark grayish brown cherty silt loam about 2 inches thick. The subsurface layer is brown cherty silt loam about 4 inches thick. The subsoil is yellowish red clay in the upper part and red and dark red clay in the lower part. Hard dolomite bedrock is at a depth of about 30 inches. In some areas the subsoil is browner.

Typically, the surface layer of the Gasconade soil is very dark brown flaggy silty clay loam about 4 inches thick. The upper part of the subsoil is very dark grayish

brown very flaggy silty clay about 7 inches thick. The lower part is dark brown very flaggy clay about 5 inches thick. The subsoil is underlain by hard dolomite bedrock. In places the depth to bedrock is less than 16 inches.

Included with these soils in mapping are small areas of rock outcrop on knobs and shoulder slopes. Also included are areas of the deep, well drained Gepp soils at the edges of the mapped areas. Included areas make up about 10 percent of the map unit.

Permeability is moderate in the Bardley soil and moderately slow in the Gasconade soil. Surface runoff is rapid on both soils. The available water capacity is low in the Bardley soil and very low in the Gasconade soil. Natural fertility and the organic matter content are low in the Bardley soil and moderate in the Gasconade soil. These soils cannot be tilled because of the high content of chert fragments and flagstones on the surface. Root penetration is restricted by hard bedrock at a depth of about 30 inches in the Bardley soil and at a depth of about 16 inches in the Gasconade soil.

Most areas of the Bardley soil support native hardwoods. Most areas of the Gasconade soil support warm-season grasses and eastern redcedar. These soils are unsuited to cultivated crops because of the slope, the restricted rooting depth, and the coarse fragments on the surface.

The Bardley soil is well suited to cool-season grasses, such as tall fescue, and warm-season grasses, such as Caucasian bluestem, big bluestem, and indiangrass. The Gasconade soil is better suited to warm-season grasses than to cool-season grasses. The hazard of erosion during seedbed preparation, the chert in the surface layer, and the droughtiness are the major management concerns in areas of both soils. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. The cherty surface layer limits seedbed preparation. The best method of tillage is one in which a heavy disk is used. Broadcast seeding generally is needed. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Overgrazing, especially during dry summer months, depletes the cover of grasses and legumes and increases the extent of weeds.

These soils generally are suited to trees. Most areas support second-growth stands of post oak, hickory, and eastern redcedar. Seedling mortality, the equipment limitation, and the windthrow hazard are management concerns. The seedling mortality rate can be reduced by planting container-grown stock or by reinforcement planting. Planting by hand may be necessary because of the content of coarse fragments on the surface. Windthrow often occurs after heavy thinning. This hazard generally can be overcome by lighter, less intensive but more frequent thinning when a reduction of stand density is needed for maximum growth potential. Woodland management should include selective thinning, the removal of undesirable trees, fire prevention, and controlled grazing.

These soils generally are unsuited to building site development and onsite waste disposal; however, they are being used extensively for development around the Lake of the Ozarks. The depth to bedrock and the slope are limitations on sites for septic tank absorption fields and sewage lagoons. In areas of the Bardley soil, the moderate permeability is an additional limitation on sites for septic tank absorption fields and seepage is a limitation on sites for sewage lagoons. Large stones in the Gasconade soil create construction problems and must be removed. Sites for these uses should be in the less sloping areas where the soils are deepest over bedrock. Additions of suitable fill material may be needed to ensure that the soil is deep enough to adequately filter the effluent. Also, suitable borrow material is needed for construction of sewage lagoons because of the depth to bedrock. Sealing the bottom of the lagoon helps to prevent the pollution of ground water. In most cases, the effluent must be pumped to the septic tank absorption field or lagoon because the best sites generally are in the higher areas of the map unit.

The depth to bedrock, the moderate shrink-swell potential, and the slope are limitations on building sites. The large stones in the Gasconade soil create construction problems and must be removed. Buildings should be designed so that they conform to the natural slope of the land. Also, the depth to bedrock should be considered. Reinforcing footings and foundations helps to prevent the structural damage caused by shrinking and swelling.

Low strength, the depth to bedrock, the shrink-swell potential, the slope, and the potential for frost action are limitations on sites for local roads and streets. The large stones in the Gasconade soil cause construction problems and must be removed. Strengthening the base material with crushed rock or other suitable material helps to overcome low strength. Grading the roads so that they shed water, constructing roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Some ripping or blasting of bedrock is needed for the construction of roadbeds. Ripping or blasting the bedrock is difficult. Roads should be designed so that they conform to the natural slope of the land.

The land capability classification is VIIe. The woodland ordination symbol is 2D.

12A—Cedargap cherty silt loam, clayey substratum, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on flood plains along small streams. It is frequently flooded for very brief periods. Individual areas are long and narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark gray cherty silt loam about 8 inches thick. The subsurface layer is black and very dark gray cherty silt loam and very cherty loam about 23 inches thick. The substratum to a depth of about 60 inches is brown very cherty silty clay loam and very cherty silty clay. In some areas the dark surface layer is less than 24 inches thick.

Included with this soil in mapping are small areas of Razort soils and small areas of Cedargap soils that have a surface layer of silt loam. The included Cedargap soils are farther from the current stream channels than the major Cedargap soil. Razort soils are on the slightly higher stream terraces and alluvial fans. They have a surface layer of silt loam and have less chert throughout than the Cedargap soil. Also included are small areas of gravelly outwash where the streams overflow their banks. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the upper part of the Cedargap soil and moderately slow in the lower part. Surface runoff is slow. The available water capacity is low. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable, but tillage is difficult because of the content of chert.

Most areas are used for pasture or hay. Some areas support native hardwoods. Because of the low available water capacity and the flooding, this soil generally is not used for cultivated crops. It is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza, ladino clover, and red clover. Flooding and drought are the main hazards in the areas used for pasture or hay. Flooding during the spring often damages seedlings. Therefore, a seedbed should be prepared and seed planted in the fall. Grasses and legumes respond well to soil amendments. The chert in the surface layer limits the use of equipment. Seedbeds generally are prepared with a heavy disk, and seeds are planted by broadcasting. Dragging the field helps to cover the seed. The careful use of haying equipment minimizes the damage caused by the content of chert. Overgrazing, especially during dry summer months, depletes the cover of grasses and legumes and increases the extent of weeds.

This soil is suited to trees. Because of the low available water capacity, the seedling mortality rate is a management concern. It can be reduced by planting container-grown nursery stock or by reinforcement planting. Selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is unsuited to building site development, sanitary facilities, and local roads and streets because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 3F.

13A—Cedargap silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on flood plains along small streams. It is frequently flooded for very brief periods. Individual areas are long and narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is very dark grayish brown silt loam and cherty silt loam about 19 inches thick. The upper part of the substratum is very dark gray extremely cherty silty clay loam. The lower part to a depth of 60 inches or more is dark brown extremely cherty silty clay loam. In some areas the dark surface layer is less than 24 inches thick.

Included with this soil in mapping are small areas of Razort soils and small areas of Cedargap soils that have a surface layer of cherty silt loam. The included Cedargap soils are adjacent to the stream channels. Razort soils are on the slightly higher stream terraces and alluvial fans. They have less chert in the substratum than the Cedargap soil. Also included are small areas of gravelly outwash where the streams overflow their banks. Included areas make up about 10 percent of the map unit.

Permeability is moderate in the Cedargap soil. Surface runoff is slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. Because of the flooding, this soil generally is not used for cultivated crops. It is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza, ladino clover, and red clover. Flooding is the main hazard. It often damages new seedlings in the spring. Therefore, a seedbed should be prepared and seed planted in the fall. Grasses and legumes respond well to soil amendments.

Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds.

This soil is suited to trees. Some areas support native hardwoods. There are no significant management concerns; however, selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing can improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is unsuited to building site development, sanitary facilities, and local roads and streets because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 3A.

14B—Peridge silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on foot slopes and terraces. Most areas are irregular in shape and range from about 5 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown silt loam. The lower part is reddish brown silty clay loam. In some areas, the surface layer is darker and the subsoil has more gravel.

Included with this soil in mapping are small areas of Cedargap soils and the poorly drained Moniteau soils. Cedargap soils are dark and have more chert than the Peridge soil. They are along old stream channels. Moniteau soils are in shallow depressions generally adjacent to the uplands. Included soils make up about 5 to 10 percent of the map unit.

Permeability is moderate in the Peridge soil. Surface runoff is medium. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in areas where it contains material from the subsoil.

Most areas are used for pasture or hay. A few areas are used for cultivated crops. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza, red clover, ladino clover, and alfalfa. Erosion is a hazard in newly seeded areas. It can be controlled by planting a companion crop of small grain or by timely tillage and seeding. Renovating grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds. If stock water ponds are constructed on this soil, a sealer may be needed to prevent seepage.

This soil is suited to soybeans, grain sorghum, and small grain grown in rotation with pasture and hay crops. Erosion is a hazard if cultivated crops are grown. A system of conservation tillage that leaves a protective cover of crop residue on the surface, stripcropping, winter cover crops, and grassed waterways help to prevent excessive soil loss. A few areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Some type of grade-stabilization structure generally is needed if grassed waterways are established. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Some areas support native hardwoods. There are no significant management concerns; however, selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable for building site development and onsite waste disposal. The moderate permeability is a limitation on sites for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area. Leveling may be needed on sites for sewage lagoons. Sealing the bottom of the lagoon helps to prevent seepage.

On sites for local roads and streets, crushed rock or other suitable material is needed to strengthen the base material. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. The woodland ordination symbol is 4A.

14C—Peridge silt loam, 5 to 9 percent slopes. This very deep, moderately sloping, well drained soil is on foot slopes and terraces. Most areas are irregular in shape and range from about 5 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish red silty clay loam, and the lower part is yellowish red cherty silty clay loam. In eroded areas the surface layer is browner. In places the subsoil has a lower content of coarse fragments.

Included with this soil in mapping are small areas of Cedargap, Clarksville, and Gepp soils. Cedargap and Clarksville soils have more chert than the Peridge soil. The dark Cedargap soils are along narrow drainageways. Clarksville and Gepp soils generally are

in the higher areas. Gepp soils have more chert in the surface layer and more clay in the subsoil than the Peridge soil. Included soils make up about 5 to 15 percent of the map unit.

Permeability is moderate in the Peridge soil. Surface runoff is medium. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle after hard rains, especially in areas where it contains material from the subsoil.

Most areas are used for pasture or hay. A few areas are used for cultivated crops. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza, red clover, ladino clover, and alfalfa. Erosion is a hazard in newly seeded areas. It can be controlled by planting a companion crop of small grain or by timely tillage and seeding. Renovating grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds. Timely mowing of pastures helps to control the competition from undesirable plants and results in a more uniform distribution of grazing.

This soil is suited to soybeans, grain sorghum, and small grain. Erosion is a severe hazard if cultivated crops are grown. A system of conservation tillage that leaves a protective cover of crop residue on the surface, stripcropping, winter cover crops, and grassed waterways help to prevent excessive soil loss. A few areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Some type of grade-stabilization structure generally is needed if grassed waterways are established. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Some areas support native hardwoods. There are no significant management concerns; however, selective harvesting of mature trees, thinning second-growth stands, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable for building site development and onsite waste disposal if the design of the structures compensates for the slope. The moderate permeability is a limitation on sites for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area. Leveling may be needed on sites for sewage lagoons. Sealing the bottom of the lagoon helps to prevent seepage. Buildings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary.

On sites for local roads and streets, crushed rock or other suitable material is needed to strengthen the base material. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

16D—Clarksville very cherty silt loam, 9 to 14 percent slopes. This very deep, strongly sloping, somewhat excessively drained soil is on convex side slopes in the uplands. Individual areas generally are irregular in shape and range from about 10 to 100 acres in size.

Typically, the surface layer is very dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is pale brown very cherty silt loam about 12 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown extremely cherty silty clay loam. The next part is yellowish red, mottled extremely cherty silty clay. The lower part is dark red, mottled extremely cherty clay. In some areas the subsoil has less chert. In other areas the upper part of the subsoil has more clay.

Included with this soil in mapping are areas of the well drained Peridge soils. These soils are on foot slopes. They have a surface layer of silt loam and contain less chert in the subsoil than the Clarksville soil. Included soils make up about 8 to 10 percent of the map unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. Surface runoff is rapid. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but it cannot be easily tilled because of the high content of chert.

Most areas support native hardwoods. Some areas are used as pasture. This soil is unsuitable for cultivation because of the high content of chert, the slope, and the low fertility.

This soil is well suited to lespedeza and to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass. It is moderately suited to ladino clover and red clover. The droughtiness, the hazard of erosion, and the cherty surface layer are the main management concerns. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Warm-season grasses grow well if properly managed. Including individual pastures of cool- and

warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. The cherty surface layer hinders seedbed preparation. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Proper stocking rates and timely deferment of grazing improve the pasture.

This soil is suited to trees. Because of the low available water capacity, the seedling mortality rate is a management concern. It can be reduced by planting container-grown nursery stock or by reinforcement planting. Selective thinning, removal of undesirable trees, fire prevention, and controlled grazing improve the woodland. These measures also improve the habitat for woodland wildlife, especially white-tailed deer and wild turkey.

Because of the slope and seepage, this soil generally is unsuitable as a site for sewage lagoons. It generally is suitable for building site development and septic tank absorption fields. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. On sites for septic tank absorption fields, installing the distribution lines across the slope helps to prevent downhill seepage.

Local roads and streets should be designed so that they conform to the natural slope of the land. Cutting and filling are needed in some areas. Constructing adequate roadside ditches and installing culverts minimize the damage caused by frost action.

The land capability classification is VIe. The woodland ordination symbol is 3F.

20C—Doniphan very cherty silt loam, 3 to 9 percent slopes. This very deep, gently sloping and moderately sloping, well drained soil is on narrow, convex ridgetops and short, uneven shoulder slopes in the uplands. Individual areas are somewhat narrow and irregularly shaped and range from about 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 10 inches thick. The subsoil is about 47 inches thick. The upper part is strong brown cherty silty clay loam mixed with material from the subsurface layer. The next part is strong brown or dark red, mottled silty clay or clay. The lower part is mottled dark red, strong brown, and light brownish gray extremely cherty clay. In some places the upper part of the subsoil has more chert. In other places the soil does not have chert in the surface layer or subsurface layer.

Included with this soil in mapping are Bardley soils, the somewhat excessively drained Clarksville soils, and the moderately well drained Lebanon soils. Bardley soils are moderately deep over bedrock. They are commonly in low saddles or on breaks or knobs of ridges. Clarksville soils contain more chert and less clay in the subsoil than the Doniphan soil. They are on the steeper side slopes. Lebanon soils have a silt loam surface layer and a fragipan. They are on the wider parts of ridgetops. Included soils make up about 10 to 15 percent of the map unit.

Permeability is moderate in the Doniphan soil. Surface runoff is medium. The available water capacity is low. Natural fertility and the organic matter content also are low. The surface layer is friable but cannot be easily tilled because of the content of chert.

This soil is suited to trees. Most of the acreage supports native hardwoods (fig. 6). Some areas are pastured. Because of the high content of chert and the low available water capacity, the soil generally is not used for cultivated crops. Seedling mortality and the equipment limitation are management concerns in wooded areas. Reinforcement planting may be needed because of the low available water capacity, and planting by hand may be necessary because of the content of coarse fragments. Selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing can improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is well suited to lespedeza and to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass. It is moderately suited to ladino clover and red clover. The droughtiness and the very cherty surface layer are the main management concerns. Drought-tolerant grasses and shallow-rooted legumes are the best suited species. Warm- and cool-season grasses grow well if managed properly. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. Proper stocking rates and timely deferment of grazing improve the pasture.

This soil is suited to building site development and onsite waste disposal. The moderate permeability is a limitation on sites for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area. Seepage, the slope, and large stones are limitations on sites for sewage lagoons. These limitations generally can be overcome by properly designing the lagoon, grading the site, sealing the bottom of the lagoon, and removing the larger stones. Properly designing and reinforcing footings, foundations, and basement walls and backfilling with sand or gravel minimize the damage to buildings caused by shrinking and swelling.

Figure 6.—Native hardwoods in an area of Doniphan very cherty silt loam, 3 to 9 percent slopes.

On sites for local roads and streets, providing crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by frost action and by shrinking and swelling.

The land capability classification is IVe. The woodland ordination symbol is 3F.

22E—Gasconade-Rock outcrop complex, 5 to 20 percent slopes. This map unit consists of a shallow, moderately sloping to moderately steep, somewhat excessively drained Gasconade soil intermingled with areas of Rock outcrop. It is on ridgetops, side slopes, and benches in glade areas. Individual areas are irregular in shape and range from about 5 to more than 200 acres in size. They are about 65 percent Gasconade soil and 25 percent Rock outcrop.

Typically, the surface layer of the Gasconade soil is very dark gray cherty silty clay loam about 3 inches thick. The subsoil is dark brown very cherty silty clay loam and very cherty silty clay about 15 inches thick. Hard dolomite bedrock is at a depth of about 18 inches. In places the depth to bedrock is less than 18 inches.

The Rock outcrop occurs as exposed ledges of dolomite.

Included in mapping are areas of the moderately deep, well drained Bardley soils. These soils are in areas where less Rock outcrop is exposed. They make up about 10 percent of the map unit.

Permeability is moderately slow in the Gasconade soil. Surface runoff is rapid. The available water capacity is very low. Natural fertility is medium, and the organic matter content is moderate. The surface layer is firm and flaggy and cannot be easily tilled. Root penetration is restricted by the hard bedrock at a depth of about 18 inches.

Most areas of this unit support native warm-season grasses and eastern redcedar (fig. 7). This unit generally is unsuited to cultivated crops, to the commercial production of trees, and to building site development and onsite waste disposal because of the slope, the shallow rooting depth, the coarse fragments in the surface layer, and the Rock outcrop. The eastern redcedar can be used for posts.

The land capability classification is VIIs. The woodland ordination symbol for the Gasconade soil is 2D. The Rock outcrop is not assigned a woodland ordination symbol.

26—Moniteau silt loam. This very deep, nearly level, poorly drained soil is on stream terraces. It is subject to rare flooding and receives runoff from the adjacent uplands. Individual areas range from about 10 to more than 100 acres in size.

Typically, the surface layer is gray silt loam about 5 inches thick. The subsurface layer is light brownish

Figure 7.—Warm-season grasses and eastern redcedar in an area of Gasconade-Rock outcrop complex, 5 to 20 percent slopes.

gray, mottled silt loam about 18 inches thick. The subsoil to a depth of 60 inches or more is light brownish gray, mottled silty clay loam. In some areas the upper part of the subsoil has less clay. In other areas the subsurface layer is thicker.

Included with this soil in mapping are the well drained Peridge and Nolin soils and the somewhat poorly drained Hartville soils. Peridge soils are on foot slopes, and Nolin soils are on flood plains. Hartville soils have more clay than the Moniteau soil. They are in the more sloping areas on terraces. Also included are a few small areas that are subject to ponding during periods of heavy rainfall. Included areas make up about 5 to 10 percent of the map unit.

Permeability is moderately slow in the Moniteau soil. Surface runoff is slow. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. A perched water table is within a depth of 1 foot during most winter and spring months.

Most areas are used for pasture or hay. This soil is well suited to tall fescue and to shallow-rooted legumes, such as lespedeza, ladino clover, and red clover. It is moderately suited to orchardgrass, Caucasian bluestem, and indiangrass. The wetness is a limitation affecting deep-rooted legumes. Diversion terraces are effective in controlling the runoff from the adjacent uplands. A surface drainage system is needed to

prevent ponding in some depressions. Overgrazing or grazing when the soil is wet reduces forage yields and results in surface compaction and poor tilth.

This soil is suited to corn, soybeans, and small grain. The seasonal high water table and the runoff from the adjacent uplands can delay planting and harvesting. Minimizing tillage and returning crop residue to the soil or regularly adding other organic material improves tilth and minimizes crusting. Diversion terraces are effective in controlling the runoff from the adjacent uplands. A surface drainage system is needed to prevent ponding in some depressions.

This soil is suited to trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only during periods when the soil is dry or frozen. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. Windthrow often occurs after heavy thinning. As a result, less intensive, more frequent thinning is needed.

This soil generally is unsuited to building site development and onsite waste disposal because of the rare flooding and the seasonal high water table. Soils that are better suited to these uses generally are nearby.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

29—Nolin silt loam. This very deep, nearly level, well drained soil is on flood plains along the major streams and their larger tributaries. It is occasionally flooded. Individual areas generally are long and narrow and range from about 10 to more than 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown silt loam, and the lower part is brown silty clay loam. In some of the lower areas, the surface layer is darker.

Included with this soil in mapping are small areas of Cedargap, Peridge, and Moniteau soils. Cedargap soils are cherty. They have a dark surface layer that is thicker than that of the Nolin soil. They are in areas adjacent to the current channels of the smaller streams. Peridge soils have more chert in the subsoil than the Nolin soil. They are in the more sloping areas adjacent to the uplands. Moniteau soils are poorly drained and are in shallow depressions generally adjacent to the uplands. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Nolin soil. Surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. Some areas are used for cultivated crops. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as alfalfa, ladino clover, and red clover. The occasional flooding is the main management concern. It can damage seedlings in the spring. Therefore, a seedbed should be prepared and seed planted in the fall. Deep-rooted legumes, such as alfalfa, grow well if they are properly managed, especially if supplemental water is provided.

This soil is suited to corn and soybeans and to winter wheat and other small grain crops. The occasional flooding is a hazard. Selecting crops that can be planted later in the growing season reduces the risk of crop damage caused by floodwater. Some areas receive excessive runoff from the adjacent uplands. This runoff can damage crops unless it is controlled by diversion terraces.

This soil is suited to trees. There are no significant management concerns. Black walnut is a species of high value that can be grown on this soil. Selective thinning, removal of undesirable trees, fire prevention, and controlled grazing improve the woodland.

This soil generally is unsuitable for building site development and onsite waste disposal because of the occasional flooding.

The land capability classification is IIw. The woodland ordination symbol is 11A.

30A—Kaintuck loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on flood plains adjacent to the current channels of large streams and rivers. It is frequently flooded. Most areas are long and narrow and range from about 10 to more than 50 acres in size.

Typically, the surface layer is dark brown loam about 5 inches thick. The substratum extends to a depth of 60 inches or more. The upper part is brown, dark brown, and yellowish brown, stratified loam, fine sandy loam, and silt loam. The lower part is loamy sand. In some areas the surface layer is darker. In other areas the substratum contains less sand.

Included with this soil in mapping are small areas of Huntington and Nolin soils and areas of gravelly and sandy outwash. Huntington and Nolin soils are silty throughout. They are farther from the current stream channels than the Kaintuck soil. The gravelly and sandy outwash is in areas along the stream channels. Included areas make up about 15 percent of the map unit.

Permeability is moderately rapid in the Kaintuck soil.

Surface runoff is slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for pasture or hay. Some areas are used for cultivated crops, dominantly grain sorghum and small grain. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to shallow-rooted legumes, such as lespedeza, red clover, and ladino clover. A cover of grasses is effective in controlling the scouring caused by flooding. Flooding can damage seedlings in the spring. Therefore, a seedbed should be prepared and seed planted in the fall.

This soil is suited to cultivated crops. Onsite investigation and knowledge of the flooding history of a given area are needed if cultivated crops are grown. Selecting crops that can be planted later in the growing season reduces the risk of flood damage. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to walnut and other trees of high value. The use of equipment is limited because of the frequent flooding. Harvesting activities may be delayed during and immediately after flooding. Selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIIw. The woodland ordination symbol is 7W.

31A—Razort silt loam, 0 to 3 percent slopes. This very deep, nearly level and very gently sloping, well drained soil is on flood plains and low terraces along small streams. It is subject to rare flooding of brief duration. Individual areas are long and narrow and range from about 5 to more than 50 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 53 inches thick. In sequence downward, it is brown, mottled silt loam; brown, mottled clay loam; brown gravelly silty clay loam; and brown, mottled very gravelly clay loam. In some areas the surface layer is thinner. In other areas the subsoil has almost no chert.

Included with this soil in mapping are small areas of Cedargap and Peridge soils. Cedargap soils have more chert fragments than the Razort soil. They are adjacent to the stream channels. Peridge soils have a surface layer that is lighter in color than that of the Razort soil. They are on foot slopes. Included soils make up about 10 to 15 percent of the map unit.

Permeability is moderate in the Razort soil. Surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. This soil is well suited to cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as alfalfa, ladino clover, red clover, and lespedeza. Deep-rooted legumes, such as alfalfa, grow well if they are properly managed, especially if supplemental water is provided.

This soil generally is suited to grain sorghum and small grain. Onsite investigation and knowledge of the flooding history of a given area are needed if cultivated crops are grown. Many areas are too small or too narrow for the use of large farm machinery. A system of conservation tillage that leaves a protective cover of crop residue on the surface or regular additions of other organic material help to control erosion, improve fertility, minimize crusting, and increase the rate of water infiltration.

This soil is suited to walnut and other trees of high value. There are no significant management concerns; however, selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil generally is unsuited to building site development and onsite waste disposal because of the flooding.

The land capability classification is IIe. The woodland ordination symbol is 9A.

32C—Viraton silt loam, 3 to 9 percent slopes. This very deep, gently sloping and moderately sloping, moderately well drained soil is on convex ridgetops. Most areas are irregular in shape and range from about 20 to more than 100 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The part of the subsoil above the fragipan is about 14 inches thick. In sequence downward, it is yellowish brown, mottled silty clay loam; strong brown, mottled cherty silty clay loam; and pale brown, mottled cherty silty clay loam. The fragipan is about 11 inches thick. It is light brownish gray, mottled extremely cherty silt loam. The part of the subsoil below the fragipan extends to a depth of more than 60 inches.

It is dark red, mottled cherty clay in the upper part and red, mottled clay in the lower part. In places the part of the subsoil above the fragipan has less chert.

Included with this soil in mapping are areas of Lebanon soils. These soils contain more clay in the subsoil than the Viraton soil. They are on the broader, less sloping ridgetops. Also included are soils that contain more chert above the fragipan than the Viraton soil. These soils are on narrow ridgetops and on breaks to the steeper slopes. Included soils make up about 15 percent of the map unit.

Permeability is moderate above the fragipan in the Viraton soil, very slow in the fragipan, and moderately slow below the fragipan. Surface runoff is medium. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. Root penetration is restricted by the compact fragipan at a depth of about 19 inches. A perched water table is at a depth of 1.5 to 2.5 feet during most winter and spring months.

Most areas are used for pasture or hay. Some areas are used for cultivated crops, dominantly grain sorghum and small grain. Some areas support native hardwoods. This soil is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover. It is generally unsuited to deep-rooted legumes because of the restricted rooting depth.

The hazard of erosion and the droughtiness are the major management concerns in areas used as pasture. Erosion is a hazard if the pasture is tilled before it is seeded. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. Renovating grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Timely seeding and a high level of management are needed to establish and maintain a pasture and to prevent excessive erosion. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in the summer. Controlled grazing is needed early in spring and late in fall, when the soil is wet.

Suitable sites for stock water ponds generally are available in areas of this soil, but seepage is a management concern. The ponds should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard, and the low available water capacity is a limitation. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, crop rotations that include close-growing pasture or hay crops, and contour stripcropping help to prevent excessive soil loss. In some areas the slopes are long enough to be terraced. The fragipan is close enough to the surface, however, to hinder both terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to deciduous and coniferous trees. Conifers generally grow better than deciduous trees. The main management concerns are the windthrow hazard and seedling mortality. Windthrow often occurs after heavy thinning, especially of conifers. Less intensive, more frequent thinning reduces the windthrow hazard. Planting container-grown nursery stock or reinforcement planting increases the seedling survival rate. Selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable for most types of building site development and onsite waste disposal. Seasonal wetness on building sites can be reduced by installing tile drains around basement walls and footings. The very slow permeability in the fragipan and the seasonal wetness above the fragipan are severe limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function adequately. A sewage lagoon can function well if it is properly designed and if the site is leveled and the berms and bottom are sealed to prevent the contamination of ground water.

The wetness and the potential for frost action are limitations on sites for local roads and streets. These limitations can be overcome by grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

33F—Knobby-Rock outcrop complex, 20 to 50 percent slopes. This map unit consists of a very shallow, moderately steep and very steep, well drained Knobby soil intermingled with areas of Rock outcrop. It is on uneven side slopes and benches. Individual areas are irregular in shape and range from about 5 to more than 100 acres in size. They are about 50 percent Knobby soil and 40 percent Rock outcrop.

Typically, the surface layer of the Knobby soil is

black gravelly fine sandy loam about 4 inches thick. The subsurface layer is dark brown very gravelly fine sandy loam about 5 inches thick. Bedrock is at a depth of about 9 inches. In some places the depth to bedrock is more than 9 inches.

The Rock outcrop occurs as exposed ledges of dolomite.

Included in mapping are areas of the moderately deep Bardley soils. These soils are in small areas where less Rock outcrop is exposed. They make up about 10 percent of the map unit.

Permeability is moderate in the Knobby soil. Surface runoff is rapid. The available water capacity is very low. Natural fertility is low, and the organic matter content is moderate. Root penetration is restricted by the hard bedrock at a depth of about 9 inches.

Most areas of this unit support warm-season grasses and eastern redcedar. This unit is unsuited to cultivated crops, pasture, and most trees because of the very shallow rooting depth. Most areas are idle or are used for light grazing or for growing eastern redcedar used for posts.

This unit generally is unsuitable for building site development and onsite waste disposal because of the slope, the depth to bedrock, and the Rock outcrop.

The land capability classification is VIIs. The woodland ordination symbol is 2F.

34C—Gatewood cherty silt loam, 5 to 9 percent slopes. This moderately deep, moderately sloping, moderately well drained soil is on side slopes and narrow ridges in the uplands. Individual areas are irregular in shape and range from about 10 to more than 100 acres in size.

Typically, the surface layer is dark brown cherty silt loam about 4 inches thick. The subsurface layer is yellowish brown cherty silt loam about 6 inches thick. The subsoil is about 25 inches thick. It is strong brown and yellowish brown, mottled clay. The substratum is yellowish brown clay underlain by hard dolomite bedrock at a depth of about 38 inches. In some areas the upper part of the subsoil is redder.

Included with this soil in mapping are areas of the somewhat excessively drained Gasconade soils. They are less than 20 inches deep over bedrock. They are in glade areas where benches break to the steeper slopes. Also included are soils that are more than 40 inches deep over bedrock. They are on the lower side slopes near drainageways. Included soils make up about 10 to 15 percent of the map unit.

Permeability is slow in the Gatewood soil. Surface runoff is medium. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is friable, but tillage is difficult because of the coarse fragments. Root development is restricted by the hard bedrock at a depth of about 38 inches.

Most areas of this soil are used for pasture or hay. Some areas support native timber. This soil generally is not used for cultivated crops because of the low available water capacity and the low fertility. It is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover.

The hazard of erosion, the high content of chert in the surface layer, and the droughtiness are the major management concerns in areas used as pasture. Erosion is a hazard if the pasture is tilled before it is seeded. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in the summer.

This soil is suited to trees. There are no significant management concerns; however, selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable as a site for dwellings without basements. The shrink-swell potential is a limitation. Properly designing and reinforcing footings and foundations can minimize the damage caused by shrinking and swelling. The soil is better suited to dwellings without basements than to dwellings with basements because of the moderate depth to bedrock.

The depth to bedrock, seepage, and the slope are severe limitations if this soil is used as a site for sewage lagoons. The slow permeability and the depth to bedrock are severe limitations on sites for septic tank absorption fields. A properly constructed mound of suitable material helps to overcome these limitations. Additional soil material is needed on sites for sewage lagoons. Generally, suitable borrow material is available in the adjacent areas.

The shrink-swell potential, the potential for frost action, and low strength are limitations if this soil is used as a site for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Providing crushed rock, gravel, or other suitable

base material minimizes the damage caused by low strength.

The land capability classification is IVe. The woodland ordination symbol is 2A.

34D—Gatewood cherty silt loam, 9 to 14 percent slopes. This moderately deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 200 acres in size.

Typically, the surface layer is very dark grayish brown cherty silt loam about 3 inches thick. The subsurface layer is brown cherty silt loam about 3 inches thick. The subsoil is about 18 inches thick. It is yellowish brown and dark yellowish brown, mottled cherty clay and clay. It is underlain by hard, gray dolomite bedrock at a depth of about 24 inches. In some areas the upper part of the subsoil is redder. In other areas the soil is slightly deeper over bedrock.

Included with this soil in mapping are areas of Gasconade and Gunlock soils. Gasconade soils are less than 20 inches deep over bedrock. They are in glade areas, generally on the south- and west-facing slopes. Gunlock soils have a surface layer of silt loam. They are on toe slopes near drainageways. Also included are areas of soils that are more than 40 inches deep over bedrock. They are on the lower side slopes near drainageways. Included soils make up about 10 to 15 percent of the map unit.

Permeability is slow in the Gatewood soil. Surface runoff is rapid. The available water capacity is very low. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable, but tillage is difficult because of the content of coarse fragments. Root development is restricted by the hard bedrock at a depth of about 24 inches.

Most areas are used for timber or pasture. Because of the slope and the low available water capacity, this soil generally is not suitable for cultivated crops. It is well suited to tall fescue, Caucasian bluestem, indiangrass, and shallow-rooted legumes, such as lespedeza. It is moderately suited to orchardgrass.

The hazard of erosion, the content of chert in the surface layer, and the droughtiness are the major management concerns in areas used as pasture. Erosion is a hazard if the pasture is tilled before it is seeded. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. The chert in the surface layer hinders seedbed preparation. Because of the erosion hazard, timely tillage and a quickly established ground cover are necessary. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds, especially during dry periods in the summer.

This soil is suited to trees. There are no significant management concerns; however, selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable as a site for dwellings without basements, but the slope and the shrink-swell potential are limitations. The slope can be overcome by land shaping. Also, the dwellings can be designed so that they conform to the natural slope of the land. Properly designing and reinforcing footings and foundations can minimize the damage caused by shrinking and swelling. The soil is better suited to buildings without basements than to buildings with basements because of the moderate depth to bedrock.

The depth to bedrock, seepage, and the slow permeability are severe limitations on sites for septic tank absorption fields. A properly constructed mound of suitable material helps to overcome these limitations. Additional soil material is needed on sites for sewage lagoons because of the depth to bedrock. Generally, suitable borrow material is available in the adjacent areas.

The shrink-swell potential, the potential for frost action, and low strength are limitations if this soil is used as a site for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Providing crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is VIe. The woodland ordination symbol is 2A.

35B—Lebanon silt loam, 2 to 5 percent slopes. This very deep, gently sloping, moderately well drained soil is on convex ridgetops. Individual areas are irregular in shape and range from about 5 to more than 200 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The part of the subsoil above the fragipan is about 17 inches thick. It is strong brown silty clay loam and silty clay in the upper part and grayish brown, mottled silty clay in the lower part. The very dense fragipan is about 14 inches thick. It is light brownish gray, mottled extremely cherty silt loam. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is reddish brown, mottled very cherty clay in the upper part and dark reddish brown, mottled cherty clay in the lower part.

Included with this soil in mapping are the somewhat

poorly drained Plato soils and some areas of Viraton soils. Plato soils are in the less sloping depressional areas. Viraton soils have less clay than the Lebanon soil. They are in areas that break to steeper slopes. Included soils make up about 5 to 10 percent of the map unit.

Permeability is moderately slow above the fragipan in the Lebanon soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in eroded areas where it contains material from the subsoil. Root penetration is restricted by the compact fragipan at a depth of about 23 inches. A perched water table is at a depth of 1 to 2 feet during most winter and spring months.

Most areas are used for pasture or hay. Some areas are used for cultivated crops, dominantly grain sorghum and small grain. Some areas support native hardwoods.

This soil is well suited to warm- and cool-season grasses, such as Caucasian bluestem, indiangrass, tall fescue, and orchardgrass, and to shallow-rooted legumes, such as lespedeza. It is moderately suited to ladino clover and red clover. A cover of these grasses and legumes is effective in controlling erosion. Deep-rooted legumes generally do not grow well because of the restricted rooting depth. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. Renovating grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Erosion is a hazard if the pasture is tilled before it is seeded. Timely tillage and a quickly established ground cover are necessary. Grazing when the soil is wet, especially in early spring and late fall, causes surface compaction, excessive runoff, and poor tilth.

Suitable sites for stock water ponds generally are available in areas of this soil, but seepage is a management concern. The ponds should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard. An insufficient amount of soil moisture commonly is a limitation affecting row crops that are grown during summer. Also, spring planting may be delayed by seasonal wetness. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, stripcropping, and contour farming help to prevent excessive soil loss. In some areas the soil has slopes that are long enough and smooth enough to be terraced. The fragipan is close enough to the surface, however, to hinder terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. Conifers generally grow better than deciduous trees. The windthrow hazard is the main management concern. It often occurs after heavy thinning, especially of conifers. Less intensive, more frequent thinning reduces the windthrow hazard. Thinning second-growth stands, removing undesirable trees, preventing fire, and controlling grazing improve the woodland.

This soil is suitable for building site development and onsite waste disposal. Excessive wetness during winter and spring is a problem on building sites. Installing tile drains around footings minimizes the damage caused by wetness. The very slow permeability in the fragipan and the seasonal wetness above the fragipan are limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function well. The slope is a limitation on sites for sewage lagoons, but the sites generally can be easily leveled. In residential areas sanitary facilities should be connected to any available commercial sewers.

Low strength, the wetness, and the potential for frost action are limitations if this soil is used as a site for local roads and streets. Providing crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Constructing roadside ditches and installing culverts minimize the damage caused by frost action and by wetness.

The land capability classification is IIe. The woodland ordination symbol is 3D.

37B—Hartville silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil is on foot slopes and terraces. Individual areas generally are long and narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is brown, mottled silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown, mottled silty clay loam. The next part is strong brown and light brownish gray, mottled silty clay. The lower part is yellowish brown, light brownish gray, and strong brown, mottled silty clay. In some areas the surface layer is darker.

Included with this soil in mapping are areas of the well drained Cedargap and Peridge soils and the poorly drained Moniteau soils. Cedargap soils have more chert

than the Hartville soil. They are adjacent to the current channels of small streams. Peridge soils have less clay than the Hartville soil. They are on the higher foot slopes. Moniteau soils have less clay in the upper part of the subsoil than the Hartville soil. They are on the less sloping parts of terraces. Included soils make up about 10 to 15 percent of the map unit.

Permeability is slow in the Hartville soil. Surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderate. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains. A perched high water table is at a depth of 1.5 to 3.0 feet during most winter and spring months.

Most areas are used for pasture or hay. Some areas are used for cultivated crops. This soil is well suited to tall fescue, indiangrass, ladino clover, and lespedeza. It is moderately suited to orchardgrass, Caucasian bluestem, and red clover. The wetness is a limitation affecting deep-rooted legumes. The species that can best withstand wetness should be selected for planting. Diversion terraces are effective in controlling the runoff from the adjacent uplands. Because erosion is a hazard during seedbed preparation, timely tillage and a quickly established ground cover are necessary. Overgrazing or grazing when the soil is wet reduces the extent of the grasses and legumes and causes surface compaction and poor tilth.

This soil is suited to corn, soybeans, grain sorghum, and small grain. The seasonal high water table and the runoff from the adjacent uplands can delay planting and harvesting. Erosion also is a hazard. It can be controlled by winter cover crops, stripcropping, contour farming, and a system of conservation tillage that leaves a protective cover of crop residue on the surface. A few areas have slopes that are long enough and smooth enough to be terraced. Returning crop residue to the soil or regularly adding other organic material improves tilth and minimizes crusting. Diversion terraces are effective in controlling the runoff from the adjacent uplands.

This soil is suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. Windthrow commonly occurs after heavy thinning. Less intensive, more frequent thinning reduces the windthrow hazard. Selective thinning, removal of undesirable trees, fire prevention, and controlled grazing improve the woodland.

This soil is suitable for building site development and onsite waste disposal. The wetness and the shrink-swell potential are major concerns on sites for dwellings with basements. Soils that are better suited generally are nearby. Properly designing and reinforcing footings, foundations, and basement walls and backfilling with sand or gravel minimize the damage caused by shrinking and swelling. Installing tile drains around the footings minimizes the damage caused by excessive wetness. Sewage lagoons can function adequately, but some leveling is needed.

The shrink-swell potential, the potential for frost action, and low strength are limitations if this soil is used as a site for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Providing crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IIe. The woodland ordination symbol is 3C.

38—Riverwash. This map unit consists of sand and gravel along current stream channels and old stream channels (fig. 8). It is frequently flooded. The floodwater deposits new material and mixes the material that is already deposited. The drainage class varies. Shallow pools are common. Individual areas range from about 5 to more than 50 acres in size.

Included with the Riverwash in mapping are small areas of Cedargap and Kaintuck soils. These soils are along the edge of the stream channels and on the higher islands. They make up about 10 to 15 percent of the map unit.

The Riverwash generally is sparsely vegetated with willows and a few small sycamore trees. Some included areas support a dense stand of sycamore, elm, and ash. A few areas are mined for sand or gravel, generally by a mechanical loader. The mined material is hauled from the site and used as base material for roads, as fill, or as an ingredient in concrete. These areas generally are mined for short periods, but some have been mined for several years.

This unit generally is unsuited to any type of development and to grasses and trees because of the frequent flooding. Wetland wildlife habitat can be developed in some areas. Natural travel lanes for wildlife are along the waterways. Canoeists and fishermen commonly use the gravel bars as campsites.

No land capability classification or woodland ordination symbol is assigned.

40—Huntington silt loam. This very deep, nearly level, well drained soil is on flood plains. It is frequently flooded. Some small areas are dissected by stream

Figure 8.—An area of Riverwash.

channels. Individual areas generally are long and narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown and brown silt loam about 13 inches thick. The subsoil is about 39 inches thick. The upper part is brown silt loam. The lower part is brown, mottled silty clay loam. In some areas the dark upper layers are more than 24 inches thick. In other areas the surface layer is silty clay loam or loam.

Included with this soil in mapping are areas of Cedargap and Kaintuck soils and small areas of sandy and gravelly overwash. Cedargap soils have more chert than the Huntington soil. They are on flood plains along the smaller streams. Kaintuck soils have more sand than the Huntington soil. They are on the lower parts of the flood plains, adjacent to the current stream channels. The overwash is in low areas adjacent to the

stream channels. Included areas make up about 10 percent of the map unit.

Permeability is moderate in the Huntington soil. Surface runoff is slow. The available water capacity is high. Natural fertility and the organic matter content also are high. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used for pasture or hay. Some areas are used for cultivated crops. This soil is well suited to most cool- and warm-season grasses, such as tall fescue, orchardgrass, Caucasian bluestem, and indiangrass, and to legumes, such as alfalfa, ladino clover, red clover, and lespedeza. A cover of these grasses and legumes is effective in controlling the scouring caused by floodwater. The flooding limits the suitability of some species. Also, it can damage seedlings in the spring. Therefore, a seedbed should be prepared and seed planted in the fall. Deep-rooted legumes, such as alfalfa, grow well if they are properly managed, especially if supplemental water is provided.

This soil is suited to corn and soybeans and to winter wheat and other small grain crops. The flooding is the major hazard. Selecting crops that can be planted later in the growing season reduces the risk of crop damage in areas where flooding is not controlled. Some areas receive excessive runoff from the adjacent uplands. This runoff can damage crops unless it is controlled by diversion terraces.

This soil is suited to trees. A few isolated areas are wooded. Black walnut is a species of high value that can be grown on this soil. There are no significant management concerns; however, selective thinning, removal of undesirable trees, fire prevention, and controlled grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 9A.

41B—Plato silt loam, 1 to 4 percent slopes. This very deep, very gently sloping and gently sloping, somewhat poorly drained soil is on broad, convex ridgetops. Individual areas are irregular in shape and range from about 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The part of the subsoil above the fragipan is about 20 inches thick. It is yellowish brown, mottled silty clay loam in the upper part and yellowish brown and grayish brown, mottled silty clay in the lower part. The next 16 inches is a very dense fragipan of yellowish brown and light brownish gray, mottled cherty silty clay loam. The part of the subsoil below the fragipan to a depth of 60 inches or more is yellowish red and dark red, mottled cherty silty clay loam and very cherty silty clay. In some areas the silt loam surface layer is less than 4 inches thick.

Included with this soil in mapping are areas of the moderately well drained Lebanon and Viraton soils. Lebanon soils are in landscape positions similar to those of the Plato soil. They are browner in the upper part of the subsoil than the Plato soil. Viraton soils have more chert and less clay above the fragipan than the Plato soil. They are in the more sloping areas of the map unit. Included soils make up about 5 to 10 percent of the map unit.

Permeability is moderately slow above the fragipan in the Plato soil, very slow in the fragipan, and moderate below the fragipan. Surface runoff is slow. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains, especially in eroded areas where it contains material from the subsoil. Root penetration is restricted by the compact fragipan at a depth of about 26 inches. A perched water table is at a depth of 1.0 to 2.5 feet during most winter and spring months.

Most areas are used for pasture or hay. Some areas are used for cultivated crops, dominantly grain sorghum and small grain. A few small areas support native hardwoods.

This soil is well suited to warm-season grasses, such as Caucasian bluestem and indiangrass. It is moderately suited to tall fescue and to shallow-rooted legumes, such as ladino clover. A cover of these grasses and legumes is effective in controlling erosion. Deep-rooted legumes generally do not grow well because of the restricted rooting depth. Including individual pastures of cool- and warm-season grasses in a rotation grazing system is more effective than allowing season-long grazing of any one grass species. Renovating grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth.

Suitable sites for stock water ponds generally are available in areas of this soil, but seepage is a management concern. The ponds should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to cultivated crops. Erosion is a hazard. An insufficient amount of soil moisture commonly is a limitation affecting row crops that are grown during summer. Also, spring planting may be

delayed by seasonal wetness. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, stripcropping, and contour farming help to prevent excessive soil loss. In some areas the soil has slopes that are long enough and smooth enough to be terraced. The fragipan is close enough to the surface, however, to hinder terrace construction and revegetation of the terrace channel. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. The windthrow hazard is the main management concern. Less intensive, more frequent thinning reduces the windthrow hazard. Thinning second-growth stands, removing undesirable trees, preventing fire, and controlling grazing improve the woodland.

This soil is suited to building site development and onsite waste disposal. Excessive wetness during winter and spring is a problem on building sites. Installing tile drains around footings minimizes the damage caused by wetness. Properly designing and reinforcing foundations and footings and backfilling with sand or gravel minimize the structural damage caused by shrinking and swelling. The very slow permeability in the fragipan and the seasonal wetness above the fragipan are severe limitations on sites for septic tank absorption fields. A properly constructed mound system of onsite waste disposal can function well. The slope and the wetness are limitations on sites for sewage lagoons, but most sites can be leveled and sealed to prevent the contamination of ground water. In residential areas sanitary facilities should be connected to any available commercial sewers.

The wetness, the shrink-swell potential, the potential for frost action, and low strength are limitations if this soil is used as a site for local roads and streets. Constructing roadside ditches and installing culverts minimize the damage caused by wetness, shrinking and swelling, and frost action. Adding crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IIe. The woodland ordination symbol is 3D.

42C—Gunlock silt loam, 3 to 9 percent slopes. This very deep, gently sloping and moderately sloping, moderately well drained soil is on the lower side slopes and foot slopes in the uplands. Individual areas range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is dark brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is brown and strong brown, mottled silty clay loam. The next part is yellowish brown and grayish brown, mottled silty clay loam that is compact and slightly brittle. The lower part is dark yellowish brown and strong brown, mottled silty clay and cherty clay. In some of the less sloping areas, the upper part of the subsoil has grayish brown mottles.

Included with this soil in mapping are areas of the somewhat excessively drained Cedargap and Gatewood soils and the well drained Lebanon soils. Cedargap soils have a dark upper layer that is thicker than that of the Gunlock soil. They are adjacent to drainageways. Gatewood soils are less than 40 inches deep over bedrock. They are on nose slopes and the steeper side slopes, generally on the upper parts of the landscape. Lebanon soils have a fragipan. They are on the small, less sloping ridges or terraces. Included soils make up about 10 to 15 percent of the map unit.

Permeability is moderately slow in the Gunlock soil. Surface runoff is medium. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. A perched water table is at a depth of 2 to 3 feet during most winter and spring months.

Most areas are used for pasture or hay. A few areas are used for cultivated crops. This soil is well suited to tall fescue, indiangrass, ladino clover, and lespedeza. It is moderately suited to orchardgrass, Caucasian bluestem, and red clover. A cover of grasses and legumes is effective in controlling erosion. Erosion is a hazard during seedbed preparation. This hazard can be reduced by timely seeding and by planting a companion crop of small grain. Renovating grass pastures with legumes increases the amount of forage and improves the quality of the hay and pasture. Timely mowing of pastures helps to control competition from undesirable plants and results in a more uniform distribution of grazing.

This soil generally is suited to soybeans, grain sorghum, and small grain. Erosion is a hazard. A system of conservation tillage that leaves a protective cover of crop residue on the surface, stripcropping, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas the soil has slopes that are long enough and smooth enough to be terraced and farmed on the contour. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to trees. There are no significant management concerns; however, selective harvesting of

mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil is suitable for building site development and onsite waste disposal. The moderately slow permeability and the excessive wetness are limitations on sites for septic tank absorption fields, but they generally can be overcome by a properly constructed mound system. The soil is suitable for sewage lagoons if the site can be leveled. Sealing the bottom of the lagoons with slowly permeable material helps to prevent the contamination of ground water. Properly designing and reinforcing footings and basement walls and backfilling with sand or gravel minimize the damage caused by shrinking and swelling. Installing tile drains around the footings minimizes the damage caused by excessive wetness.

Low strength, the shrink-swell potential, the potential for frost action, and the wetness are limitations if this soil is used as a site for local roads and streets. Strengthening the subgrade with crushed rock or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

43F—Poynor very cherty silt loam, 14 to 35 percent slopes. This very deep, moderately steep and steep, well drained soil is on uneven side slopes. Individual areas are irregularly shaped and range from about 20 to more than 200 acres in size.

Typically, the surface layer is brown very cherty silt loam about 2 inches thick. The subsurface layer is pale brown very cherty silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown very cherty silty clay loam. The next part is strong brown, mottled very cherty silty clay loam. The lower part is red and yellowish red, mottled clay. In some areas the upper part of the subsoil has more clay. In other areas the depth to bedrock is less than 60 inches.

Included with this soil in mapping are areas of the moderately well drained Gatewood soils. These soils are less than 40 inches deep over bedrock. They are on nose slopes and benches. They make up about 10 percent of the map unit.

Permeability is moderate in the Poynor soil. Surface runoff is rapid. The available water capacity is low. Natural fertility and the organic matter content also are low.

This soil is unsuited to cultivated crops because of the slope, the available water capacity, and the high content of chert fragments. It is moderately suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza. Establishing and maintaining a pasture can be difficult. The hazard of erosion, the chert fragments in the surface layer, and the droughtiness are the main management concerns. A crawler tractor and a heavy disk may be needed for seedbed preparation. Tillage generally should be avoided. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates, pasture rotation, and timely deferment of grazing improve the pasture. Overgrazing depletes the cover of grasses and legumes and increases the extent of weeds. Effective brush control may be difficult because the slope limits the use of equipment.

This soil generally is unsuitable as a site for stock water ponds because of seepage. The ponds should be sealed, or alternative water supplies, such as pipelines, should be considered.

This soil is suited to trees. Most areas support native hardwoods. The equipment limitation, the hazard of erosion, and seedling mortality are the main management concerns. The equipment limitation and the erosion hazard can be minimized by carefully selecting and managing sites for logging roads and skid trails. Because of the chert, planting seedlings by hand or direct seeding may be necessary. North- and east-facing slopes are the best sites for seedlings. Planting container-grown stock also increases the seedling survival rate. Reinforcement planting may be needed. Selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing improve the woodland. These measures also improve the habitat for most kinds of woodland wildlife.

This soil generally is unsuitable for building site development and sanitary facilities because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

46F—Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes, stony. These very deep, moderately steep and steep soils are on uneven side slopes. The well drained Gepp soil is on upland side slopes and benches. Generally, it is lower on the landscape than the Clarksville soil. The somewhat excessively drained Clarksville soil is in the steeper areas above the benches. Individual areas of this unit are irregular in shape and range from about 20 to more than 200 acres in size. They are about 60 percent

Clarksville soil and 30 percent Gepp soil. Stones cover less than 0.1 percent of the surface in most areas.

Typically, the surface layer of the Clarksville soil is dark grayish brown very cherty silt loam about 4 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 18 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown, mottled very cherty silt loam and extremely cherty silty clay loam. The next part is strong brown and yellowish red very cherty silty clay loam. The lower part is red, mottled very cherty silty clay.

Typically, the surface layer of the Gepp soil is brown very cherty silt loam about 3 inches thick. The subsurface layer is light yellowish brown very cherty silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish red, mottled cherty silty clay loam. The lower part is dark red, mottled clay and cherty clay. In some areas the upper part of the subsoil has more chert. In other areas the slope is more than 35 percent.

Included with these soils in mapping are small areas of Doniphan and Peridge soils. Doniphan soils have more clay and less chert in the upper part of the subsoil than the Clarksville soil. They have a surface layer that is thicker than that of the Gepp soil. They are on the shoulder slopes of ridges. Peridge soils are less cherty than the Clarksville soil and less clayey than the Gepp soil. They are on foot slopes. Also included, in areas where the hillside benches break to steeper slopes, are some small areas that are less than 60 inches deep over bedrock. Included areas make up about 10 percent of the map unit.

Permeability is moderately rapid in the upper part of the Clarksville soil and moderate in the lower part. It is moderate in the Gepp soil. Surface runoff is rapid on both soils. The available water capacity is low in the Clarksville soil and moderate in the Gepp soil. Natural fertility is low in both soils. The organic matter content is moderately low.

These soils are unsuited to cultivated crops because of the slope, the high content of chert, and the low fertility. They are moderately suited to cool- and warm-season grasses, such as tall fescue, Caucasian bluestem, and indiangrass, and to legumes, such as lespedeza. Accessible areas can be used as pasture, but the droughtiness, the slope, the hazard of erosion, and the chert fragments in the surface layer are problems. A crawler tractor and a heavy disk may be needed for seedbed preparation. Tillage should be avoided if possible. Seed can be planted by broadcasting or by aerial applications. Proper stocking rates, pasture rotation, and timely deferment of grazing improve the pasture. Effective brush control may be difficult because the slope limits the use of equipment.

These soils generally are unsuitable as sites for stock water ponds because of excessive seepage. The ponds should be sealed, or alternative water supplies, such as pipelines, should be considered.

These soils are suited to trees. Most areas support second-growth stands of black oak and post oak. Some small stands of white oak are on the north- and east-facing slopes. The main management concerns are the equipment limitation, seedling mortality, and the hazard of erosion. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails. Some disturbed areas should be seeded after the trees are harvested. Because of the chert, planting seedlings by hand may be necessary. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. Selective thinning, removal of undesirable trees and other competing vegetation, fire prevention, and controlled grazing improve the woodland.

These soils generally are unsuitable for building site development and onsite waste disposal; however, they are being used extensively for development around the Lake of the Ozarks. The slope and the high content of chert fragments on the surface are management concerns on sites for dwellings. The moderate permeability and the shrink-swell potential also are limitations in areas of the Gepp soil. The slope can be overcome only by extensive land shaping or by designing the dwellings so that they conform to the natural slope of the land. The moderate permeability in the Gepp soil is a limitation on sites for septic tank absorption fields. It can be overcome in some places by increasing the size of the absorption field, by using a pressure system to distribute the effluent in the absorption field, or by building a properly constructed mound system. Reinforcing foundations and footings and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling.

The potential for frost action and the slope are limitations if these soils are used as sites for local roads and streets. Low strength also is a limitation in areas of the Gepp soil. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by frost action. The roads and streets should be constructed on the contour. A substantial amount of cutting and filling generally is needed. Ripping or blasting of bedrock generally is necessary. Strengthening the subgrade with crushed rock, gravel, or other suitable material minimizes the damage caused by low strength.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

47F—Niangua-Bardley very cherty silt loams, 14 to 50 percent slopes, very stony. This unit consists of deep and moderately deep, moderately steep to very steep, well drained soils on uneven side slopes and benches. The Niangua soil generally is on side slopes above or between the benched areas. The Bardley soil is on the lower part of side slopes and on benches and nose slopes. Individual areas of this unit are irregular in shape and range from about 20 to more than 100 acres in size. They generally are about 50 percent Niangua soil and 40 percent Bardley soil. Stones cover as much as 3 percent of the surface.

Typically, the surface layer of the Niangua soil is black very cherty silt loam about 3 inches thick. The subsurface layer is pale brown very cherty silt loam about 11 inches thick. The subsoil is about 38 inches thick. The upper part is red, mottled cherty silty clay and clay. The lower part is yellowish brown, mottled cherty clay. A 3-inch bed of chert overlies hard dolomite bedrock at a depth of about 52 inches. In some areas the soil is more than 60 inches thick. In other areas the upper part of the subsoil has less clay.

Typically, the surface layer of the Bardley soil is dark brown very cherty silt loam about 2 inches thick. The subsurface layer is pale brown very cherty silt loam about 3 inches thick. The subsoil is about 23 inches thick. The upper part is red cherty clay and clay. The lower part is yellowish red, mottled cherty clay. Hard dolomite bedrock is at a depth of about 28 inches. In some areas the upper part of the subsoil is strong brown.

Included with these soils in mapping are areas of Cedargap and Doniphan soils. Cedargap soils are cherty throughout. They have less clay than the Niangua and Bardley soils. They are on flood plains. Doniphan soils have a very cherty surface layer as much as 20 inches thick that is underlain by red clay. They are on shoulder slopes on the upper part of side slopes. Also included are small areas of the shallow Gasconade soils and narrow bands of rock outcrop. These areas generally are on the south- and west-facing side slopes and nose slopes. Included areas make up about 10 percent of the map unit.

Permeability is moderately slow in the Niangua soil and moderate in the Bardley soil. Surface runoff is rapid on both soils. The available water capacity is low. Natural fertility and the organic matter content also are low. Root penetration is restricted by the dolomite bedrock at a depth of about 28 inches in the Bardley soil.

These soils are unsuited to cultivated crops because of the slope, the high content of chert, and the low fertility. Most areas are used as woodland and support black oak and post oak. Some small areas of white oak stands are on the north- and east-facing slopes. There also are isolated glade areas that support native grasses and eastern redcedar, mostly on the south- and west-facing slopes. The hazard of erosion, the equipment limitation, and seedling mortality are management concerns in wooded areas. The windthrow hazard also is a concern on the Bardley soil. Roads and skid trails should be established on the contour to minimize erosion damage. Seeding of disturbed areas may be necessary after harvesting is completed. Planting container-grown stock by hand increases the seedling survival rate. Reinforcement planting may be needed. Windthrow often occurs after heavy thinning. It generally can be reduced by lighter, less intensive but more frequent thinning when a reduction of stand density is needed for maximum growth potential. Woodland management should include selective harvesting of mature trees, thinning second-growth stands, removing cull trees, preventing fire, and controlling grazing. These measures also improve the habitat for woodland wildlife, especially white-tailed deer and wild turkey.

These soils are moderately suited to tall fescue, Caucasian bluestem, indiangrass, and shallow-rooted legumes, such as lespedeza. Grasses and legumes can be used as pasture in areas where access is feasible. However, pastures can be difficult to establish and maintain. The slope and chert fragments in the surface layer are the main management concerns. A crawler tractor and a heavy disk may be needed for seedbed preparation. Tillage should be avoided if possible. Broadcasting or aerial seeding is needed. Proper stocking rates, pasture rotation, and timely deferment of grazing improve the pasture. Effective brush control may be difficult because the slope limits the use of equipment.

These soils generally are unsuitable as sites for stock water ponds because of the slope and the depth to bedrock. Alternative water supplies, such as pipelines or wells, should be considered.

These soils generally are unsuitable for building site development and onsite waste disposal; however, they are being used extensively for development around the Lake of the Ozarks (fig. 9). The slope and the chert fragments on the surface are management concerns. Additional concerns are the shrink-swell potential and the wetness in areas of the Niangua soil and the depth to bedrock in the Bardley soil. The slope can generally be overcome by extensive land shaping, which typically includes the removal of some bedrock, or by designing the structures so that they conform to the natural slope of the land. The moderately slow permeability in the Niangua soil and the moderate depth to bedrock in the Bardley soil are limitations on sites for septic tank

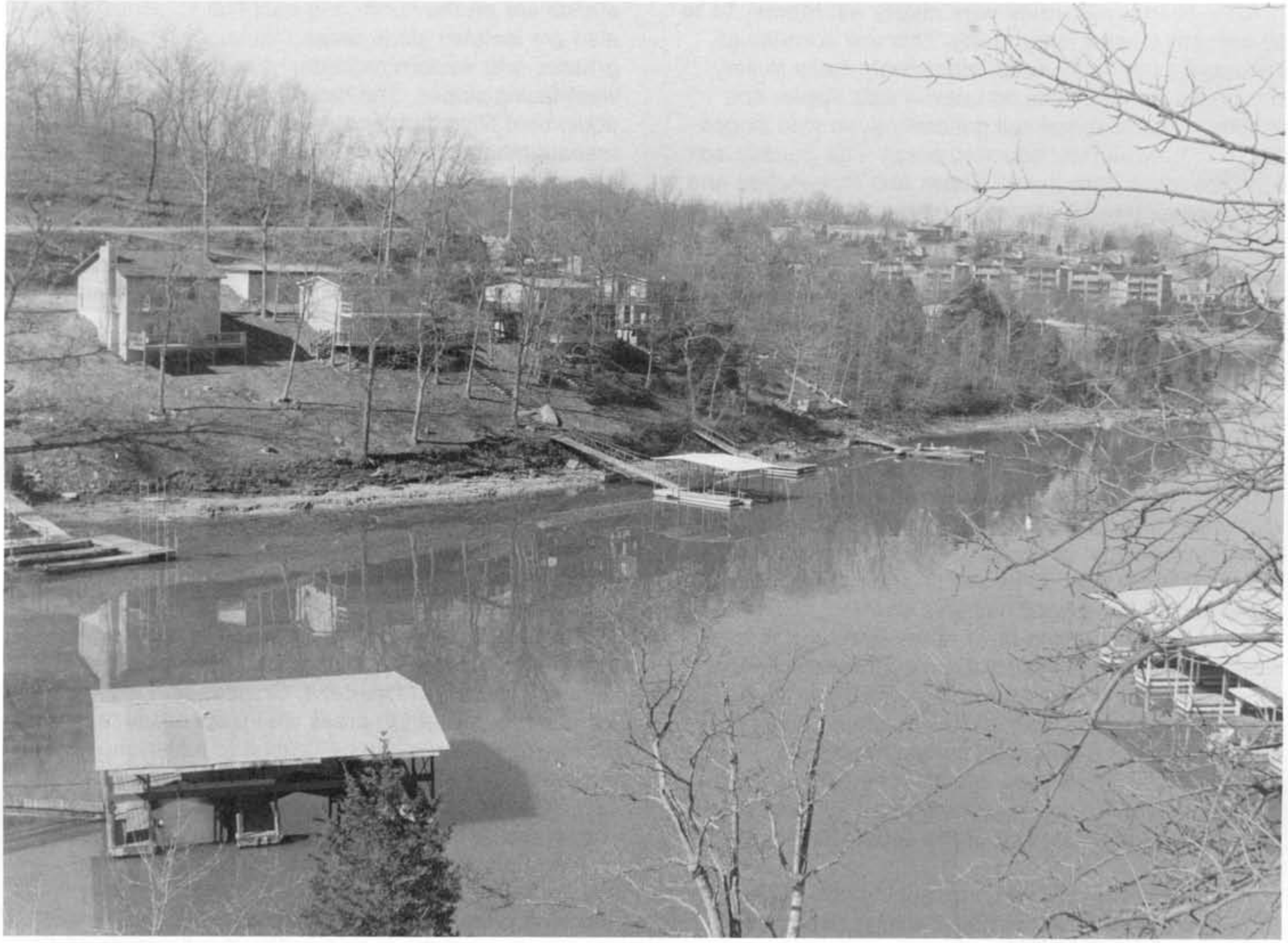

Figure 9.—Building site development in an area of Niangua-Bardley very cherty silt loams, 14 to 50 percent slopes, very stony, adjacent to the Lake of the Ozarks.

absorption fields. In some instances, these limitations can be overcome by increasing the size of the absorption field, by using a pressure system to distribute the effluent in the absorption field, or by building a properly constructed mound system. Because of the depth to bedrock and the content of chert, the construction of sewage lagoons may require additions of borrow material or ripping or blasting. Ripping or blasting the bedrock is difficult. Sealing the bottom of the lagoons helps to prevent excessive seepage.

The shrink-swell potential and the depth to bedrock are limitations on sites for dwellings with basements. The depth to bedrock can be overcome by constructing the buildings a sufficient distance above the bedrock or by blasting or ripping the bedrock. Reinforcing foundations and footings and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling.

Low strength, the shrink-swell potential, the potential for frost action, and the slope are limitations if these soils are used as sites for local roads and streets. Strengthening the base material with crushed rock, gravel, or other suitable material minimizes the damage caused by low strength. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Constructing local roads and streets along the contour helps to

overcome the slope. A substantial amount of cutting and filling generally is needed. Ripping or blasting of bedrock generally is necessary. Ripping or blasting the bedrock is difficult.

The land capability classification is VIIe. The woodland ordination symbol is 3R for the Niangua soil and 2R for the Bardley soil.

48G—Rock outcrop-Bardley complex, 35 to 99 percent slopes. This unit consists of Rock outcrop occurring as ledges and high cliffs or bluffs intermingled with the moderately deep, very steep, well drained Bardley soil on side slopes along rivers and streams. Individual areas are long and narrow and range from about 10 to more than 100 acres in size. They generally are about 60 percent Rock outcrop and 25 percent Bardley soil. Stones cover about 5 percent of the surface.

The Rock outcrop includes ledges, very steep to nearly vertical bluff faces, and talus consisting of gravel, stones, and huge boulders intermixed with soil particles that have sloughed off the higher adjacent side slopes.

Typically, the surface layer of the Bardley soil is dark grayish brown very cherty silt loam about 3 inches thick. The subsoil is about 19 inches thick. It is red clay in the upper part and reddish brown clay in the lower part. Hard dolomite bedrock is at a depth of about 22 inches. In some areas the subsoil is browner.

Included in mapping are areas of the somewhat excessively drained Gasconade soils. These soils are less than 20 inches deep over bedrock. They generally are in landscape positions directly above the Rock outcrop. They make up about 10 percent of the map unit.

Permeability is moderate in the Bardley soil. Surface runoff is rapid. The available water capacity is low. Natural fertility and the organic matter content also are low.

This map unit is unsuited to pasture and cultivated crops because of the slope.

With the exception of the bluff faces, most areas of this unit support oak timber. Some small glade areas support native grasses and cedars. The best trees are on the uppermost part of the side slopes or on the talus. This unit generally is not used for the commercial production of trees; however, selected trees occasionally are harvested during logging activities on adjacent soils.

Some features of this unit, such as caves, springs, and scenic views, have esthetic qualities. The unit also provides habitat for woodland wildlife, particularly birds and small game.

This unit is unsuitable for building site development and onsite waste disposal because of the slope, the depth to bedrock, and the stones.

The land capability classification is VIII. The woodland ordination symbol for the Bardley soil is 2R. The Rock outcrop is not assigned a woodland ordination symbol.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 48,000 acres in the survey area, or about 11 percent of the total acreage, meets the requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the central part, mainly in associations 3, 5, and 6, which are described under the heading "General Soil Map Units."

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the

back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Larry E. Lewis, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Most areas in Camden County that are not developed for residential or commercial purposes are used as woodland, pasture, or hayland. The soils are generally suited to grazing and to limited production of crops. Row crops and small grain, such as corn, grain sorghum, and winter wheat, are grown on only a few hundred acres.

The major concerns in managing the soils for crops and pasture are wetness, droughtiness, and the hazard of erosion. Also, the use of equipment is limited because of stoniness or the slope.

Good management practices, such as maintaining an adequate fertility level, conserving soil moisture, and maintaining or increasing soil tilth and the organic matter content, can significantly increase crop and pasture yields. The management practices needed on most of the soils that are suited to crops and pasture are described in the following paragraphs. Additional information regarding specific practices is given for each unit in the section "Detailed Soil Map Units."

Soil tests can determine the kinds and amounts of amendments needed to maintain or increase fertility levels. Maintaining records of the kinds and amounts of fertilizer applied and the time of application is useful in evaluating the yields.

Leaving large amounts of crop residue on the surface after harvesting can increase the organic matter content and keep the soil porous, thereby increasing the rate of water infiltration and the available water capacity. Crop residue management also reduces the destructive impact of falling raindrops on the soil and helps to

control runoff and erosion. Effective erosion control depends on the amount of residue and the length of time that it remains on the surface. Thus, spring plowing, which allows crop residue to remain on the surface throughout the winter, is more effective than fall plowing, which leaves the surface bare in winter.

No-till farming or another kind of conservation tillage that leaves crop residue on the surface helps to control erosion, maintains tilth, and increases the rate of water infiltration. A conservation tillage system could include the use of chisel plows, field cultivators, or no-till planters.

A continuous cropping system can be maintained in some areas, such as areas on bottom land and some nearly level areas on uplands. Special management for intensive cropping systems involves maintaining fertility, managing crop residue, and applying a system of conservation tillage.

Many good stands of grass-legume pasture have been established in the survey area. Pasture renovation is needed to improve forage quality and prevent excessive erosion. Establishing a good pasture is generally successful if a few simple management practices are followed. These practices include applying limestone and fertilizer as recommended by a current soil test, preparing a firm seedbed, planting the recommended amounts of seed and covering the seed with one-fourth to one-half inch of soil, inoculating all legume seeds with the proper bacteria within 24 hours of planting, controlling weeds until new seedlings are well established, and delaying grazing until root systems are well established. Only adapted species of grasses and legumes should be planted. Seeding dates vary for different species.

Good pasture management increases forage yields and livestock production. Rotation grazing is an important management practice. Allowing the pasture plants to be grazed too short weakens the stand and increases competition from weeds and brush. Cross-fencing and an adequate supply of water for livestock are needed for good pasture management.

The most common cool-season grasses are tall fescue and orchardgrass. They grow in the spring and fall. The most common legumes are red clover, ladino clover, and lespedeza. They are grown in mixed stands with cool-season grasses.

Most warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, indiangrass, and switchgrass, can be planted. They provide good summer forage.

A well planned and managed grazing system generally includes a mixture of cool-season grasses and legumes for spring and fall grazing and warm-season grasses for summer pasture or stockpiled cool-season grasses for summer use. Pastures are stocked with the number of livestock for which the pastures will produce adequate grazing.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation

projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(10)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use. There are no class I soils in Camden County.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. There are no class V soils in Camden County.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Wayne Wittmeyer, resource forester, Missouri Department of Conservation, helped prepare this section.

Historical records and other data indicate that at one time the survey area was completely forested. Today, as a direct result of human activity, approximately 68 percent of the survey area is forested. Most of the woodland that has been lost has been converted to pasture or was submerged during the creation of the Lake of the Ozarks.

Throughout much of the Ozarks region, which includes Camden County, the oak-hickory forest type is dominant. The major tree species are black oak, white oak, post oak, northern red oak, and blackjack oak and several species of hickory. The better species of oak, such as white oak and northern red oak, favor the deeper soils, such as those in the Clarksville-Gepp complex (fig. 10) and the Poynor soils. This is especially true in areas where these soils are on north- or east-facing slopes. The poorer tree species are post oak, blackjack oak, and some species of hickory. They are on the poorer soils, generally on ridges and on south- and west-facing slopes. The forest cover in areas of the Gunlock and Hartville soils on terraces is white oak, northern red oak, and ash. The soils on flood plains, such as Huntington and Kaintuck soils, support stands of sycamore, silver maple, boxelder, and elm. Many sites support both upland and bottom-land species.

Soil serves as a reservoir for moisture, provides an anchor for roots, and supplies most of the available plant nutrients. Reaction, natural fertility, drainage, texture, structure, depth, and position on the landscape directly or indirectly affect these growth requirements.

Available water capacity is primarily influenced by texture, rooting depth, and content of stones and chert. Huntington soils and other deep soils can have a high or very high available water capacity. The content of chert or stones affects the amount of available water in Doniphan soils. Features that restrict root development, such as bedrock, also affect the available water capacity. Gasconade soils and other soils that are shallow over bedrock have a low potential for forest production. The trees that grow on these soils withstand extreme moisture stress. The common species are eastern redcedar, chinkapin oak, blackjack oak, winged elm, and hackberry. The growth rate is slow, and the formation of the trees generally is poor.

Other site characteristics that affect tree growth include aspect and position on the landscape. These characteristics influence the amount of available sunlight, air drainage, soil temperature, and moisture content. North- and east-facing slopes are the best

Figure 10.—Loading of logs harvested from an area of Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes, stony.

upland sites for tree growth because they are generally cooler and more moist than south- and west-facing slopes.

Like much of the Ozarks region, Camden County has experienced the adversities of frequent forest burning and cattle grazing. As a result, the leaf layer on the surface has been destroyed. This layer is important because it helps to control erosion and provides plant nutrients. Also, grazing cattle can severely compact the soil. This compaction decreases the rate of water infiltration, which results in a deterioration of many sites and hinders the regeneration of many desirable timber species. Fire and grazing also damage existing stands. They commonly result in stands of undesirable species, such as blackjack oak and post oak, or in poor-quality, fire-scarred stands of desirable species. Because of these adverse conditions, forest management should be based on soil suitability and site characteristics rather than on the species growing on the site.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol,* a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a

letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume,* a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops

from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

John P. Graham, biologist, Soil Conservation Service, helped prepare this section.

Camden County provides many recreational opportunities. The major recreational attraction in the county is the Lake of the Ozarks Reservoir. A large portion of the reservoir, nearly 43,000 acres, is in Camden County. The lake provides many water-related activities, such as boating, fishing, swimming, and waterskiing.

Because of the Lake of the Ozarks, Camden County has developed into a regional vacation attraction. Numerous resorts, marinas, condominiums, and restaurants have been developed along the shoreline of the lake. Near the lake are shopping malls, golf courses, tennis courts, and campgrounds.

Both the Niangua and Little Niangua Rivers flow through the county and empty into the Lake of the Ozarks. They provide additional opportunities for swimming, fishing, and canoeing. The Little Niangua River also flows through Fiery Fork State Park, which is public land open to hunting, hiking, and camping.

Other recreational opportunities are provided by the Lake of the Ozarks State Park and Ha Ha Tonka State Park. These two state parks include approximately 14,000 acres of public land in Camden County. The Lake of the Ozarks State Park offers hiking trails, equestrian facilities, camping sites, boat ramps, marinas, swimming areas, and beaches. Ha Ha Tonka State Park has the remains of a castle that was constructed in the early part of the century. It also has some unique natural surroundings. Geologically, Ha Ha Tonka is characterized by sinks, caves, underground streams, large springs, and natural bridges. One of the largest springs in Missouri is located in the park. It feeds into the Niangua Arm of the lake. The park offers many hiking and interpretive trails and limited spelunking.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or

stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Kenneth V. Kriewitz, wildlife biologist, Missouri Department of Conservation, helped prepare this section.

Camden is one of 24 counties that comprise the Ozark Plateau Zoogeographic Region in Missouri *(7)*. This Zoogeographic Region covers a third of the state. Small areas of grassland are scattered throughout the county, but most areas are woodland. Cultivated cropland is very scarce.

Certain species of woodland wildlife are numerous. Excellent populations of deer and turkey exist throughout the county. Squirrel populations fluctuate with annual mast production but generally are good.

Furbearer populations are fair or good and are stable. The Lake of the Ozarks, which covers about one-tenth of the county, exerts a stabilizing influence on wildlife species associated with bodies of water. Raccoon, mink, beaver, and muskrat are generally plentiful. Red and gray fox, coyote, and opossum are locally abundant. Bobcats are trapped and hunted throughout the county. Striped skunks are common.

Several residents in the area participate in furbearer trapping in the winter. Success in trapping is generally good. The Lake of the Ozarks and several feeder streams offer a variety of opportunities for trapping.

Upland species, such as rabbits and quail, are not widely hunted except in special environments and generally not in sizable numbers. The land use pattern in this area and the vegetative cover generally are not conducive to upland wildlife.

Bobwhite quail populations fluctuate with the severity of winters and with the success of annual seed and mast production. In general, quail populations are fair. The best populations are in areas where row crops, grassland, and timberland intermingle to create optimum habitat.

Cottontail rabbit numbers also fluctuate annually, but generally they are rated fair or good. Some residents of the county hunt cottontail rabbits. Hunting pressure is fairly heavy for both quail and rabbits.

Several factors contribute to poor-quality wildlife habitat in certain areas. The general scarcity of row crops is a problem. Livestock are commonly allowed to graze in wooded areas. This practice destroys wildlife habitat. The historical practice of burning wooded areas in the spring also destroys the habitat.

The majority of the woodland in the county is in areas of the Niangua-Bardley and Clarksville-Doniphan-Gepp associations, described under the heading "General Soil Map Units." The other associations are partially wooded. Woodland wildlife species are associated mainly with the Niangua-Bardley and Clarksville-Doniphan-Gepp associations but are found throughout the county.

Cultivated row crops are grown mainly in the Doniphan-Lebanon-Viraton, Nolin-Peridge-Huntington, and Gatewood-Doniphan-Gunlock associations. These three associations and the Lebanon-Plato association contain most of the grassland in the county.

Excellent fishing opportunities exist in Camden County. Facilities for fishing are numerous around the Lake of the Ozarks. The Niangua and Little Niangua Rivers also offer good fishing opportunities. Numerous stocked farm ponds throughout the county provide fishing opportunities for landowners and their guests.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining

specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils

and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a

flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and the contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy

vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Soil Potentials for Septic Tank Absorption Fields

Table 13 gives the potential ratings for septic tank absorption fields. Soil potential ratings indicate the relative suitability of a soil for a particular use compared with that of other soils in a given area. The production or performance level, the feasibility and relative cost of applying modern technology to minimize the effects of soil limitations, and the adverse effects of continuing limitations, if any, on social, economic, or environmental values are considered. The criteria used in developing soil potential ratings for a particular use are established specifically for the area to which the ratings apply. The criteria may be different in nearby areas, counties, groups of states, or regions. Thus, the rating assigned to a soil for a given use in one area may differ from the rating assigned to the same soil in another area.

The ratings are developed primarily for planning purposes and are not intended as recommendations for land use. They do not identify the most profitable land use. The ratings help decision makers to determine the relative suitability of soils for a given use. They are used along with other resource information as a guide in making land use decisions. They supplement the land capability classes, soil limitation ratings, and other soil interpretations in soil handbooks and technical guides. They may be substituted for these interpretations or may supplement them in inventories and evaluations, interim soil reports, watershed work plans, Resource Conservation and Development area plans, and river basin studies prepared by the Soil Conservation Service or in reports released by conservation districts or other units of government.

Four rating classes are used to indicate the comparative potential of the soils for a given use. These classes are *high, medium, low,* and *very low*. They are defined in the following paragraphs.

High Potential.—Production or performance meets or exceeds local standards; the cost of measures that can overcome soil limitations is favorable in relation to the expected performance or production; and the limitations continuing after corrective measures are applied do not appreciably detract from environmental quality or restrict economic returns.

Medium Potential.—Production or performance is somewhat below local standards; the cost of measures that can overcome soil limitations is high; or the limitations continuing after corrective measures are applied detract from environmental quality or restrict economic returns.

Low Potential.—Production or performance is significantly below local standards; the measures required to overcome soil limitations are very costly; or the limitations continuing after corrective measures are applied appreciably detract from environmental quality or restrict economic returns.

Very Low Potential.—Production or performance is much below local standards because of unfavorable soil properties; economically feasible measures to overcome severe soil limitations are unavailable; or the soil limitations continuing after corrective measures are applied seriously detract from environmental quality or restrict economic returns.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard

construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not

favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

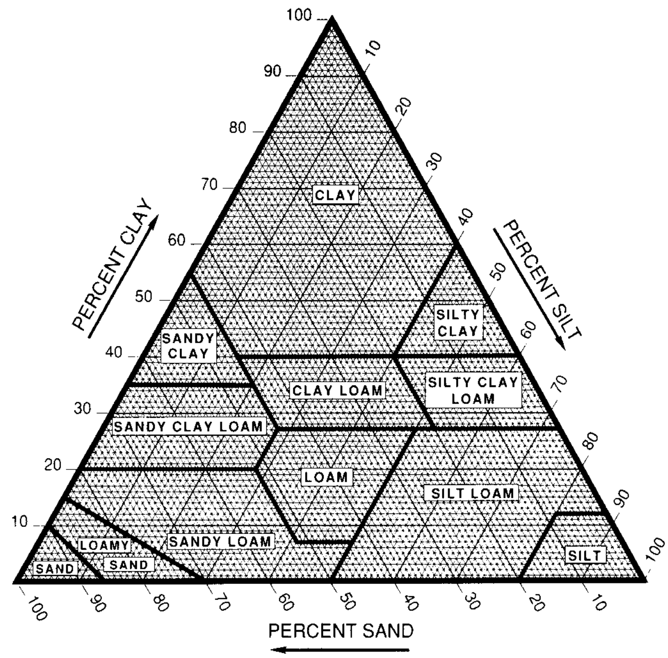

Figure 11.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 11). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and

highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For

many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal

weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(11)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Paleudults (*Pale*, meaning old, plus *udults*, the suborder of the Ultisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Paleudults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is clayey, mixed, mesic Typic Paleudults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(9)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(11)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bardley Series

The Bardley series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 5 to 100 percent.

Typical pedon of Bardley very cherty silt loam, in an area of Niangua-Bardley very cherty silt loams, 14 to 50 percent slopes, very stony; 100 feet north and 1,700 feet west of the southeast corner of sec. 4, T. 37 N., R. 17 W.

A—0 to 2 inches; dark brown (10YR 4/3) very cherty silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; about 40 percent chert fragments; slightly acid; clear smooth boundary.

E—2 to 5 inches; pale brown (10YR 6/3) very cherty silt loam; weak fine granular structure; very friable; common fine roots; about 50 percent chert fragments; slightly acid; clear smooth boundary.

2Bt1—5 to 10 inches; red (2.5YR 4/6) cherty clay; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; about 20 percent chert fragments; medium acid; gradual smooth boundary.

2Bt2—10 to 18 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; about 5 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt3—18 to 28 inches; yellowish red (5YR 4/6) cherty clay; common fine distinct red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common faint and distinct clay films on faces of peds; about 20 percent chert fragments; slightly acid; clear smooth boundary.

2R—28 inches; dolomite bedrock.

The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments in the A and E horizons ranges from 25 to 70 percent, by volume. The upper 20 inches of the argillic horizon averages more than 60 percent clay.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. The A and E horizons are the cherty to extremely cherty analogs of silt loam. The 2Bt horizon has value of 3 or 4 and chroma of 4 to 6. It is silty clay or clay or the cherty analogs of those textures. Some pedons have a 2C horizon.

Cedargap Series

The Cedargap series consists of very deep, well drained soils on narrow flood plains along small streams. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. These soils formed in silty alluvium that has a high content of chert fragments. Slopes range from 0 to 3 percent.

Typical pedon of Cedargap cherty silt loam, clayey substratum, 0 to 3 percent slopes, 200 feet south and 500 feet west of the northeast corner of sec. 14, T. 37 N., R. 15 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) cherty silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; very friable; common fine roots; about 25 percent chert fragments; neutral; abrupt smooth boundary.

A1—8 to 18 inches; black (10YR 2/1) cherty silt loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; few fine roots; about 20 percent chert fragments; neutral; clear smooth boundary.

A2—18 to 31 inches; very dark gray (10YR 3/1) very cherty loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; few fine roots; about 50 percent chert fragments; neutral; clear wavy boundary.

C1—31 to 41 inches; brown (10YR 4/3) very cherty silty clay loam; moderate fine and medium subangular blocky structure; friable; common faint coatings on faces of peds and on chert fragments; few fine rounded concretions of manganese oxide; about 55 percent chert fragments; neutral; gradual smooth boundary.

C2—41 to 60 inches; brown (7.5YR 4/4) very cherty silty clay; moderate fine and medium subangular blocky structure; firm; common faint coatings on faces of peds and on chert fragments; few fine rounded concretions of manganese oxide; about 50 percent chert fragments; neutral.

The thickness of the mollic epipedon ranges from 24 to 44 inches. The content of coarse fragments in the 10- to 40-inch control section averages 35 to 85 percent, by volume.

The A horizon has chroma of 1 to 3. It is silt loam or loam or the cherty or very cherty analogs of those textures. The C horizon has value of 2 to 5 and chroma of 1 to 4. It is the very cherty or extremely cherty analogs of silt loam, silty clay loam, clay loam, or silty clay.

Clarksville Series

The Clarksville series consists of very deep, somewhat excessively drained soils on uplands. Permeability is moderately rapid in the upper part of the profile and moderate in the lower part. These soils formed in material weathered from cherty dolomite and from sandstone. Slopes range from 9 to 35 percent.

Typical pedon of Clarksville very cherty silt loam, in

an area of Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes, stony; 1,575 feet south and 1,320 feet east of the northwest corner of sec. 36, T. 39 N., R. 16 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; very friable; many very fine roots; about 40 percent chert fragments; stones covering less than 0.1 percent of the surface in most areas; medium acid; clear smooth boundary.

E—4 to 22 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak very fine granular structure; friable; common fine and medium roots; about 55 percent chert fragments; strongly acid; gradual smooth boundary.

Bt1—22 to 32 inches; strong brown (7.5YR 5/6) extremely cherty silt loam; few fine distinct yellowish red (5YR 4/6) mottles; weak very fine subangular blocky structure; friable; few fine roots; common prominent silt coatings on faces of peds; about 65 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt2—32 to 44 inches; strong brown (7.5YR 5/6) extremely cherty silty clay loam; common fine faint reddish yellow (7.5YR 6/6) and few fine distinct yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; firm; few fine roots; few faint clay films; common prominent silt coatings on faces of peds; about 65 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt3—44 to 55 inches; strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) very cherty silty clay loam; common medium prominent light brownish gray (10YR 6/2) vertical seams; weak fine subangular blocky structure; firm; few faint clay films; about 55 percent chert fragments; extremely acid; gradual smooth boundary.

Bt4—55 to 60 inches; red (2.5YR 4/6) very cherty silty clay; common fine prominent reddish brown (5YR 4/4) mottles and common medium prominent light brownish gray (10YR 6/2) vertical seams; moderate fine subangular blocky structure; firm; few faint clay films; about 50 percent chert fragments; extremely acid.

The coarse fragments consist mainly of chert, but sandstone may be present. Typically, the fragments range in size from 2 millimeters to about 4 inches.

The A horizon has value of 2 to 6 and chroma of 1 to 3. The E horizon has value of 4 to 7 and chroma of 2 to 4. The A and E horizons are very cherty silt loam or extremely cherty silt loam. The Bt horizon has value and chroma of 4 to 6. It is the very cherty or extremely cherty analogs of silt loam, silty clay loam, or silty clay.

Doniphan Series

The Doniphan series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and material weathered from dolomite and sandstone. Slopes range from 3 to 9 percent.

Typical pedon of Doniphan very cherty silt loam, 3 to 9 percent slopes, 450 feet south and 1,550 feet east of the northwest corner of sec. 14, T. 38 N., R. 16 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; common fine and few medium roots; about 40 percent chert fragments; slightly acid; abrupt smooth boundary.

E—3 to 13 inches; pale brown (10YR 6/3) very cherty silt loam; weak very fine granular structure; friable; few fine roots; about 45 percent chert fragments; slightly acid; clear wavy boundary.

B/E—13 to 18 inches; about 70 percent strong brown (7.5YR 5/6) cherty silty clay loam (Bt) and about 30 percent pale brown (10YR 6/3) very cherty silt loam (E); weak fine subangular blocky structure; firm; few fine and medium roots; few faint clay films on faces of peds; about 30 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt1—18 to 26 inches; strong brown (7.5YR 5/6) silty clay; few fine prominent red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; less than 10 percent chert fragments; extremely acid; clear smooth boundary.

2Bt2—26 to 36 inches; dark red (2.5YR 3/6) clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very firm; few fine roots; common faint clay films on faces of peds; less than 10 percent chert fragments; extremely acid; gradual smooth boundary.

2Bt3—36 to 47 inches; dark red (2.5YR 3/6) clay; many medium prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very firm; few fine roots; common faint clay films on faces of peds; pale brown (10YR 6/3) clay seams about one-eighth inch wide and about 2 inches apart between vertical faces of peds; less than 10 percent chert fragments; extremely acid; clear smooth boundary.

3Bt4—47 to 60 inches; mottled dark red (2.5YR 3/6), strong brown (7.5YR 5/8), and light brownish gray

(10YR 6/2) extremely cherty clay; weak fine subangular blocky structure; very firm; common faint clay films on faces of peds; light brownish gray (10YR 6/2) clay seams about one-eighth inch wide and about 2 inches apart between vertical faces of peds and on chert fragments; about 70 percent chert fragments; extremely acid.

The content of coarse fragments in the A and E horizons ranges from 35 to 60 percent, by volume. The upper part of the Bt horizon has 0 to 30 percent chert. Bands that have as much as 80 percent chert are in the lower part. The upper 20 inches of the argillic horizon has 48 to 70 percent clay and less than 35 percent chert.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 3 or 4. The 2Bt horizon has hue of 2.5YR to 10YR, value of 3 to 6, and chroma of 2 to 8. The upper part of this horizon is silty clay, clay, or the cherty analogs of those textures. The lower part is clay or the very cherty or extremely cherty analogs of clay.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on uplands. Permeability is moderately slow. These soils formed in material weathered from cherty dolomite. Slopes range from 5 to 20 percent.

Typical pedon of Gasconade cherty silty clay loam, in an area of Gasconade-Rock outcrop complex, 5 to 20 percent slopes; 1,800 feet south and 2,550 feet east of the northwest corner of sec. 35, T. 37 N., R. 15 W.

A—0 to 3 inches; very dark gray (10YR 3/1) cherty silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; firm; many fine roots; about 30 percent chert and dolomite fragments; neutral; clear smooth boundary.

Bw1—3 to 8 inches; dark brown (7.5YR 3/2) very cherty silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; firm; common fine roots; about 45 percent chert and dolomite fragments; neutral; gradual smooth boundary.

Bw2—8 to 18 inches; dark brown (10YR 4/3) very cherty silty clay, brown (10YR 5/3) dry; common fine faint yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; firm; common fine roots; about 40 percent chert and dolomite fragments; mildly alkaline; clear smooth boundary.

R—18 inches; dolomite bedrock; cracks and pockets of soft weathered dolomite in the upper part.

The depth to bedrock ranges from about 10 to 20 inches. The content of chert and dolomite fragments ranges from 35 to 60 percent, by volume.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is the cherty or flaggy analogs of silty clay loam or clay loam. The Bw horizon has chroma of 2 to 4. It is the very flaggy or very cherty analogs of silty clay, clay, or clay loam.

Gatewood Series

The Gatewood series consists of moderately deep, moderately well drained, slowly permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 5 to 14 percent.

Typical pedon of Gatewood cherty silt loam, 5 to 9 percent slopes, 1,900 feet north and 1,800 feet west of the southeast corner of sec. 5, T. 37 N., R. 14 W.

A—0 to 4 inches; dark brown (10YR 4/3) cherty silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; about 30 percent chert fragments; slightly acid; clear smooth boundary.

E—4 to 10 inches; yellowish brown (10YR 5/4) cherty silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; many fine roots; about 34 percent chert fragments; medium acid; clear smooth boundary.

2Bt1—10 to 16 inches; strong brown (7.5YR 5/6) clay; common fine distinct yellowish red (5YR 4/6) and few fine prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; very firm; common fine roots; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt2—16 to 21 inches; yellowish brown (10YR 5/6) clay; common fine distinct strong brown (7.5YR 4/6) and few fine prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; few very fine roots; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt3—21 to 35 inches; yellowish brown (10YR 5/8) clay; common fine prominent yellowish brown (10YR 5/4) and few fine prominent dark red (2.5YR 3/6) mottles; moderate medium subangular blocky structure; very firm; few fine roots; common faint clay films on faces of peds; about 5 percent chert fragments; neutral; clear smooth boundary.

2C—35 to 38 inches; yellowish brown (10YR 5/6) clay; massive; very firm; few fine dolomite fragments; mildly alkaline; abrupt wavy boundary.

2R—38 inches; dolomite bedrock.

The depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments in the A and E

horizons ranges from 15 to 70 percent, by volume. The 2Bt horizon may contain as much as 20 percent chert and dolomite fragments. Some pedons do not have a C horizon.

The A and E horizons have value of 2 to 6 and chroma of 2 to 4. They are the cherty or very cherty analogs of silt loam. The 2Bt horizon has value of 4 to 6 and chroma of 4 to 8. It is silty clay, clay, or the cherty analogs of those textures.

Gepp Series

The Gepp series consists of very deep, well drained, moderately permeable soils on side slopes and benches in the uplands. These soils formed in cherty sediments and in cherty dolomite residuum. Slopes range from 14 to 35 percent.

Typical pedon of Gepp very cherty silt loam, in an area of Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes, stony; 1,320 feet south and 1,000 feet east of the northwest corner of sec. 36, T. 39 N., R. 16 W.

A—0 to 3 inches; brown (10YR 5/3) very cherty silt loam, very pale brown (10YR 7/3) dry; weak very fine granular structure; friable; many fine roots; about 40 percent chert fragments; stones covering less than 0.1 percent of the surface; medium acid; clear smooth boundary.

E—3 to 10 inches; light yellowish brown (10YR 6/4) very cherty silt loam; weak very fine granular structure; friable; common fine roots; about 45 percent chert fragments; medium acid; clear smooth boundary.

2Bt1—10 to 14 inches; yellowish red (5YR 5/6) cherty silty clay loam; common medium distinct red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine and medium roots; common prominent silt coatings and few faint clay films on faces of peds; about 30 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt2—14 to 21 inches; dark red (2.5YR 3/6) clay; common fine distinct red (2.5YR 4/8) mottles; strong fine subangular blocky structure; firm; few fine roots; common prominent silt coatings and few faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt3—21 to 30 inches; dark red (2.5YR 3/6) clay; common fine distinct red (2.5YR 4/8) mottles; strong fine and medium subangular blocky structure; very firm; many faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt4—30 to 44 inches; dark red (2.5YR 3/6) cherty clay; common fine distinct yellowish red (5YR 5/6) and few fine prominent yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; very firm; about 30 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt5—44 to 60 inches; dark red (2.5YR 3/6) cherty clay; common fine distinct red (2.5YR 4/8) and many medium prominent grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; about 20 percent chert fragments; very strongly acid.

The content of chert fragments ranges from 20 to 65 percent in the A and E horizons and from 0 to 35 percent in the B horizon. Some pedons have thin lenses with more than 60 percent chert fragments in the lower part of the B horizon, but the average content of chert fragments within the control section is less than 35 percent.

The A horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 2 to 4. The upper part of the 2Bt horizon has hue of 5YR or 7.5YR and chroma of 6 to 8. The lower part has hue of 5YR, value of 4, and chroma of 6 or hue of 2.5YR, value of 3 to 5, and chroma of 6 to 8.

Gunlock Series

The Gunlock series consists of very deep, moderately well drained soils on uplands and foot slopes. Permeability is moderately slow. These soils formed in a thin mantle of colluvium or loess and in the underlying material weathered from interbedded sandstone and cherty dolomite. Slopes range from 3 to 9 percent.

Typical pedon of Gunlock silt loam, 3 to 9 percent slopes, 1,750 feet south and 1,200 feet east of the northwest corner of sec. 35, T. 37 N., R. 15 W.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine roots; less than 5 percent chert fragments; neutral; clear smooth boundary.

A2—4 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; common fine roots; less than 5 percent chert fragments; medium acid; clear smooth boundary.

Bt1—9 to 16 inches; brown (7.5YR 5/4) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds;

less than 5 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt2—16 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; common fine distinct brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; few prominent brown (10YR 5/3) silt coatings on faces of peds; few fine rounded concretions of manganese oxide; less than 5 percent chert fragments; very strongly acid; gradual smooth boundary.

2Btx1—26 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; compact and slightly brittle; few fine roots; few faint pale brown (10YR 6/3) silt coatings on faces of peds; few fine rounded concretions of manganese oxide; less than 5 percent chert fragments; very strongly acid; clear smooth boundary.

2Btx2—33 to 39 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; compact and slightly brittle; few fine roots; dark grayish brown (10YR 4/2) clay seams about one-sixteenth inch wide and about 1 inch apart; few faint light brownish gray (10YR 6/2) silt coatings on faces of peds; few fine rounded concretions of manganese oxide; less than 5 percent chert fragments; medium acid; clear smooth boundary.

3Bt1—39 to 45 inches; dark yellowish brown (10YR 4/4) silty clay; few fine faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; very firm; common distinct clay films on faces of peds; few distinct manganese stains on peds; less than 5 percent chert fragments; slightly acid; clear smooth boundary.

3Bt2—45 to 60 inches; strong brown (7.5YR 4/6) cherty clay; few fine prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; very firm; common prominent clay films on faces of peds; few distinct manganese stains on peds; about 30 percent chert fragments; slightly acid.

The depth to horizons that have fragic characteristics ranges from 20 to 34 inches.

The Ap or A horizon has value of 3 to 6 and chroma of 2 to 5. The content of coarse fragments in this horizon is less than 10 percent, by volume. The E horizon, if it occurs, has value of 5 or 6 and chroma of 3 to 6.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The content of coarse fragments in this horizon ranges from 0 to 15 percent, by volume. This horizon is silty clay or silty clay loam.

The 2Btx horizon has hue of 10YR or 7.5YR and value and chroma of 2 to 6. The content of coarse fragments in this horizon ranges from 5 to 50 percent, by volume. This horizon is silt loam or silty clay loam or the cherty or very cherty analogs of those textures.

The 3Bt horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 3 to 8 and is mottled. The content of coarse fragments in this horizon ranges from 5 to 40 percent, by volume. This horizon is silty clay loam, silty clay, clay, or the cherty or very cherty analogs of those textures.

Hartville Series

The Hartville series consists of very deep, somewhat poorly drained, slowly permeable soils on foot slopes and terraces. These soils formed in local colluvium or alluvium. Slopes range from 2 to 5 percent.

Typical pedon of Hartville silt loam, 2 to 5 percent slopes, 2,500 feet south and 2,200 feet east of the northwest corner of sec. 35, T. 37 N., R. 18 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many very fine roots; neutral; abrupt smooth boundary.

E—6 to 10 inches; brown (10YR 5/3) silt loam; common fine distinct yellowish brown (10YR 5/6) and few fine faint light brownish gray (10YR 6/2) mottles; weak thick platy structure parting to weak fine granular; very friable; common very fine roots; few root channels filled with material from the A horizon; neutral; clear smooth boundary.

Bt1—10 to 15 inches; yellowish brown (10YR 5/4) silty clay loam; many fine prominent strong brown (7.5YR 5/6) and few fine distinct light brownish gray 10YR 6/2) mottles; moderate fine subangular blocky structure; firm; few very fine roots; common faint clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—15 to 20 inches; strong brown (7.5YR 5/6) silty clay; many fine prominent light brownish gray (10YR 6/2) and few fine prominent yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; very firm; few very fine roots; common faint clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—20 to 34 inches; light brownish gray (10YR 6/2) silty clay; many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very firm; few very fine roots; common faint clay films on faces of peds; few fine

stains of manganese oxide; strongly acid; gradual smooth boundary.

Bt4—34 to 48 inches; yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) silty clay; common fine prominent strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; very firm; few very fine roots; common faint clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt5—48 to 60 inches; strong brown (7.5YR 5/6) silty clay; many fine prominent light brownish gray (10YR 6/2) and many fine prominent yellowish brown (10YR 5/8) mottles; moderate fine subangular blocky structure; very firm; many fine stains of manganese oxide; common faint clay films on faces of peds; about 5 percent fine chert fragments; slightly acid.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has value of 4 to 6 and chroma of 2 to 6. It is silty clay loam or silty clay in the upper part and silty clay or clay in the lower part.

Huntington Series

The Huntington series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Huntington silt loam, 2,050 feet north and 900 feet west of the southeast corner of sec. 21, T. 37 N., R. 14 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; slightly acid; clear smooth boundary.

A—8 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots; neutral; clear smooth boundary.

AB—16 to 21 inches; brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) and pale brown (10YR 6/3) dry; weak fine granular structure; very dark grayish brown (10YR 3/2) coatings on faces of peds; friable; few fine roots; neutral; clear smooth boundary.

Bw1—21 to 34 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) on faces of peds; weak fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

Bw2—34 to 52 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) on faces of peds; common fine distinct dark brown (7.5YR 4/4) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

Bw3—52 to 60 inches; brown (7.5YR 4/4) silty clay loam, dark brown (10YR 3/3) on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine and medium subangular blocky structure; firm; few fine roots; neutral.

The thickness of the mollic epipedon ranges from 10 to 24 inches.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The AB horizon has value of 4 or 5 and chroma of 2 or 3. The Bw horizon has value of 4 or 5 and chroma of 3 or 4.

Kaintuck Series

The Kaintuck series consists of very deep, well drained soils on flood plains. Permeability is moderately rapid. These soils formed in loamy alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Kaintuck loam, 0 to 3 percent slopes, 1,700 feet north and 300 feet west of the southeast corner of sec. 4, T. 38 N., R. 18 W.

Ap—0 to 5 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; strongly acid; clear smooth boundary.

C1—5 to 14 inches; brown (10YR 4/3), weakly stratified loam and fine sandy loam; weak fine granular structure; friable; common fine roots; slightly acid; gradual smooth boundary.

C2—14 to 42 inches; dark brown (10YR 4/3) and brown (10YR 5/3), stratified loam and fine sandy loam that has thin bands of silt loam; appears massive but has weak bedding planes; very friable; few fine roots; neutral; gradual smooth boundary.

C3—42 to 55 inches; yellowish brown (10YR 5/6) fine sandy loam; appears massive but has weak bedding planes; very friable; few fine roots; strongly acid; clear smooth boundary.

C4—55 to 60 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; slightly acid.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. It is loam or fine sandy loam. Some pedons have an Ab horizon at a depth of 20 to 40 inches. The C horizon has value of 3 to 5 and chroma of 2 to 6. It is dominantly fine sandy loam or loam but has alternating layers or bands of silt loam, sandy loam, loamy fine sand, loamy sand, or sand. In the control section, the content of clay ranges from 12 to 18 percent and the content of fine sand or coarser sand ranges from 40 to 70 percent.

Knobby Series

The Knobby series consists of very shallow, well drained soils on uplands. Permeability is moderate. These soils formed in a thin layer of loamy material weathered from dolomite. Slopes range from 20 to 50 percent.

Typical pedon of Knobby gravelly fine sandy loam, in an area of Knobby-Rock outcrop complex, 20 to 50 percent slopes; 900 feet north and 1,100 feet east of the southwest corner of sec. 34, T. 38 N., R. 17 W.

A1—0 to 4 inches; black (10YR 2/1) gravelly fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; many fine roots; about 30 percent dolomite fragments; mildly alkaline; clear smooth boundary.

A2—4 to 9 inches; dark brown (10YR 3/3) very gravelly fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine roots; about 55 percent dolomite fragments; mildly alkaline; abrupt wavy boundary.

R—9 inches; dolomite bedrock.

The depth to bedrock is less than 10 inches.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is gravelly or very gravelly fine sandy loam, but sandy loam, loam, or the gravelly, cobbly, very gravelly, or very cobbly analogs of those textures are within the range.

Lebanon Series

The Lebanon series consists of very deep, moderately well drained soils on uplands. These soils have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. The soils formed in a thin mantle of loess or silty sediments and in cherty dolomite residuum. Slopes range from 2 to 5 percent.

Typical pedon of Lebanon silt loam, 2 to 5 percent slopes, 1,330 feet north and 1,600 feet east of the southwest corner of sec. 5, T. 37 N., R. 15 W.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.

Bt1—6 to 13 inches; strong brown (7.5YR 5/6) silty clay loam; weak fine subangular blocky structure; firm; common fine roots; few faint clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—13 to 19 inches; strong brown (7.5YR 4/6) silty clay; moderate fine subangular blocky structure; firm; few fine roots; many faint clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—19 to 23 inches; grayish brown (10YR 5/2) silty clay; common fine prominent dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; many faint clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bx—23 to 37 inches; light brownish gray (10YR 6/2) extremely cherty silt loam; few fine faint grayish brown (10YR 5/2) and common fine faint pale brown (10YR 6/3) mottles; weak thick platy structure; very firm; brittle; about 65 percent chert fragments; very strongly acid; clear smooth boundary.

3Bt1—37 to 50 inches; reddish brown (2.5YR 4/4) very cherty clay; common fine distinct reddish brown (5YR 4/4) and common fine prominent yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; common faint clay films on faces of peds; about 40 percent chert fragments; very strongly acid; clear smooth boundary.

3Bt2—50 to 60 inches; dark reddish brown (2.5YR 3/4) cherty clay; few fine distinct dark red (2.5YR 3/6) and common fine prominent yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; common faint clay films on faces of peds; about 15 percent chert fragments; very strongly acid.

Depth to the fragipan ranges from 20 to 24 inches. The content of chert fragments ranges from 0 to 20 percent above the fragipan, from 10 to 70 percent in the fragipan, and from 5 to 60 percent below the fragipan.

The A horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 2 to 6. The 2Bx horizon has value of 5 or 6. It is the cherty to extremely cherty analogs of silt loam or silty clay loam. The 3Bt horizon has hue of 10YR to 2.5YR, value of 3 to 5, and chroma of 4 to 6. It is silty clay, clay, or the cherty or very cherty analogs of those textures.

Moniteau Series

The Moniteau series consists of very deep, poorly drained soils on low stream terraces. Permeability is moderately slow. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Moniteau silt loam, 2,600 feet north and 980 feet west of the southeast corner of sec. 25, T. 38 N., R. 15 W.

Ap—0 to 5 inches; gray (10YR 5/1) silt loam, light gray (10YR 7/1) dry; moderate fine granular structure;

friable; many fine roots; few strong brown (7.5YR 4/6) stains in root channels; few fine rounded concretions of manganese oxide; neutral; clear smooth boundary.

E1—5 to 10 inches; light brownish gray (10YR 6/2) silt loam; weak fine and medium platy structure parting to weak fine subangular blocky; friable; common fine roots; few strong brown (7.5YR 4/6) stains in root channels; few fine rounded concretions of manganese oxide; slightly acid; clear smooth boundary.

E2—10 to 23 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; few fine roots; few strong brown (7.5YR 4/6) stains in root channels; few fine rounded concretions of manganese oxide; strongly acid; clear smooth boundary.

Btg1—23 to 37 inches; light brownish gray (10YR 6/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few faint clay flows in root channels and few faint clay films on faces of some peds; few fine rounded concretions of manganese oxide; very strongly acid; clear smooth boundary.

Btg2—37 to 50 inches; light brownish gray (10YR 6/2) silty clay loam; many fine and medium prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few faint clay flows in root channels and few faint clay films on faces of some peds; few fine rounded concretions of manganese oxide; about 5 percent chert fragments; slightly acid; clear smooth boundary.

Btg3—50 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; few faint clay films on faces of peds; common fine rounded concretions of manganese oxide; about 5 percent chert fragments; slightly acid.

The upper 20 inches of the argillic horizon averages 27 to 35 percent clay and ranges from 5 to 15 percent sand.

The Ap horizon has value of 4 or 5. The E horizon has value of 5 or 6 and chroma of 1 or 2. The Btg horizon has value of 4 to 6 and chroma of 1 or 2.

Niangua Series

The Niangua series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 14 to 50 percent.

Typical pedon of Niangua very cherty silt loam, in an area of Niangua-Bardley very cherty silt loams, 14 to 50 percent slopes, very stony; 1,625 feet north and 1,050 feet west of the southeast corner of sec. 16, T. 37 N., R. 17 W.

A—0 to 3 inches; black (10YR 2/1) very cherty silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine roots; about 40 percent chert fragments; stones covering as much as 3 percent of the surface; neutral; abrupt smooth boundary.

E—3 to 14 inches; pale brown (10YR 6/3) very cherty silt loam; weak fine granular structure; very friable; many fine and medium roots; about 60 percent chert fragments; medium acid; clear smooth boundary.

2Bt1—14 to 25 inches; red (2.5YR 4/6) cherty silty clay; many fine distinct yellowish red (5YR 5/6) and common fine faint dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; firm; common fine and medium roots; few faint clay films on faces of peds; about 25 percent chert fragments; strongly acid; clear smooth boundary.

2Bt2—25 to 46 inches; red (2.5YR 4/6) clay; many fine prominent brown (7.5YR 5/4) and common fine prominent brown (10YR 5/3) mottles; moderate fine subangular blocky structure; firm; few medium roots; common faint clay films on faces of peds; about 10 percent chert fragments; medium acid; gradual smooth boundary.

2Bt3—46 to 52 inches; yellowish brown (10YR 5/4) cherty clay; many fine prominent strong brown (7.5YR 4/6) and common fine prominent yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; about 25 percent chert fragments; common faint clay films on faces of peds; mildly alkaline; abrupt wavy boundary.

2R—52 inches; 3-inch chert bed overlying dolomite bedrock.

The depth to bedrock ranges from 40 to 60 inches.

The A horizon has value of 2 to 4 and chroma of 1 to 4. The E horizon has value of 5 or 6 and chroma of 3 or 4. The upper part of the 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. The lower part has hue of 7.5YR or 10YR, value of 4

or 5, and chroma of 4 to 6. This horizon is silty clay or clay or the cherty analogs of those textures.

Nolin Series

The Nolin series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Nolin silt loam, 1,950 feet south and 1,850 feet west of the northeast corner of sec. 21, T. 37 N., R. 14 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; neutral; clear smooth boundary.

Bw1—9 to 13 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many fine roots; few brown (7.5YR 5/4) silt coatings; mildly alkaline; clear smooth boundary.

Bw2—13 to 21 inches; brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable; common fine roots; common brown (7.5YR 5/4) silt coatings; mildly alkaline; clear smooth boundary.

Bw3—21 to 38 inches; brown (7.5YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common brown (7.5YR 5/4) silt coatings; mildly alkaline; clear smooth boundary.

Bw4—38 to 60 inches; brown (7.5YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; few fine roots; many brown (7.5YR 5/4) silt coatings; medium acid.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The Bw horizon has value of 4 or 5.

Peridge Series

The Peridge series consists of very deep, well drained, moderately permeable soils on foot slopes and high stream terraces. These soils formed in alluvium or in material weathered from cherty dolomite and from sandstone. Slopes range from 2 to 9 percent.

Typical pedon of Peridge silt loam, 5 to 9 percent slopes, 2,500 feet south and 1,320 feet west of the northeast corner of sec. 12, T. 37 N., R. 15 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; common fine roots; very strongly acid; abrupt smooth boundary.

Bt1—7 to 10 inches; yellowish red (5YR 4/6) silty clay loam; weak fine subangular blocky structure; friable; few fine roots; common faint clay films on faces of peds; about 3 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—10 to 15 inches; yellowish red (5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine and medium roots; common faint clay films on faces of peds; about 3 percent chert fragments; very strongly acid; clear smooth boundary.

Bt3—15 to 24 inches; yellowish red (5YR 4/6) silty clay loam; common fine prominent brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; firm; few fine and medium roots; common faint clay films on faces of peds; about 3 percent chert fragments; very strongly acid; clear smooth boundary.

Bt4—24 to 38 inches; yellowish red (5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; common dark reddish brown manganese stains; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

Bt5—38 to 52 inches; yellowish red (5YR 5/6) silty clay loam; common fine faint yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few dark reddish brown manganese stains; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

Bt6—52 to 60 inches; yellowish red (5YR 5/6) cherty silty clay loam; common fine and medium distinct strong brown (7.5YR 4/6) and common fine prominent light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; few dark reddish brown manganese stains; about 30 percent chert fragments; very strongly acid.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 5YR or 2.5YR and chroma of 6 to 8.

Plato Series

The Plato series consists of very deep, somewhat poorly drained soils on uplands. These soils have a fragipan. Permeability is moderately slow above the fragipan, very slow in the fragipan, and moderate below the fragipan. The soils formed in loess or silty sediments and in cherty dolomite residuum. Slopes range from 1 to 4 percent.

Typical pedon of Plato silt loam, 1 to 4 percent slopes, 100 feet north and 1,600 feet east of the southwest corner of sec. 19, T. 37 N., R. 18 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; mixed with material from the underlying horizon; many fine and very fine roots; medium acid; clear smooth boundary.

Bt1—6 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine and very fine roots; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt2—12 to 17 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common fine and very fine roots; common distinct clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt3—17 to 26 inches; grayish brown (10YR 5/2) silty clay; common medium prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common very fine roots; common faint clay films on faces of peds; very strongly acid; clear smooth boundary.

2Btx—26 to 42 inches; yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) cherty silty clay loam; moderate thick platy structure parting to strong fine subangular blocky; brittle; about 20 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt1—42 to 52 inches; yellowish red (5YR 5/6) cherty silty clay loam; many coarse distinct yellowish red (5YR 5/8) mottles; moderate fine subangular blocky structure; firm; about 20 percent chert fragments; strongly acid; gradual smooth boundary.

2Bt2—52 to 60 inches; dark red (2.5YR 3/6) very cherty silty clay; common medium prominent strong brown (7.5YR 5/6) and common medium prominent light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; about 50 percent chert fragments; strongly acid.

Depth to the fragipan ranges from 24 to 36 inches. The content of coarse fragments ranges from 0 to 5 percent in the A horizon, from 0 to 15 percent in the part of the B horizon above the fragipan, and from 15 to 70 percent in the fragipan.

The Ap horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6 in the upper part. It has chroma of 1 or 2 in the lower part. It is silty clay loam, silty clay, or clay. The 2Btx horizon is mottled and has chroma of 2 to 6. It is silt loam or silty clay loam or the cherty, very cherty, or extremely cherty analogs of those textures. The 2Bt horizon has hue of 10R to 10YR, value of 4 to 6, and chroma of 3 to 6. It is the cherty or very cherty analogs of silty clay loam, silty clay, or clay.

Poynor Series

The Poynor series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 14 to 35 percent.

Typical pedon of Poynor very cherty silt loam, 14 to 35 percent slopes, 10 feet north and 150 feet east of the southwest corner of sec. 35, T. 36 N., R. 15 W.

A—0 to 2 inches; brown (10YR 5/3) very cherty silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; many fine roots; about 40 percent chert fragments; very strongly acid; clear smooth boundary.

E—2 to 7 inches; pale brown (10YR 6/3) very cherty silt loam; weak very fine granular structure; friable; common fine roots; about 55 percent chert fragments; very strongly acid; clear smooth boundary.

Bt1—7 to 17 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; weak fine and very fine subangular blocky structure; firm; common fine and few medium roots; few faint clay films on faces of peds; about 45 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—17 to 23 inches; strong brown (7.5YR 5/6) very cherty silty clay loam; common medium prominent red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine and medium roots; common faint clay films on faces of peds; about 40 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt3—23 to 38 inches; red (2.5YR 4/6) clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very firm; common fine roots; many prominent clay films on faces of peds; about 10 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt4—38 to 50 inches; yellowish red (5YR 4/6) clay; common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; very firm; few fine roots; many prominent vertical clay seams about one-eighth inch thick and about 3 inches apart; about 5 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bt5—50 to 60 inches; red (2.5YR 4/8) clay; common medium prominent strong brown (7.5YR 5/6)

mottles; moderate fine and medium subangular blocky structure; very firm; few fine roots; common distinct clay films on faces of peds; many prominent light gray (10YR 7/2) vertical clay seams about one-eighth inch thick and about 2.5 inches apart; about 5 percent chert fragments; extremely acid.

The A and E horizons have value of 2 to 6 and chroma of 2 to 4. The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8. It is very cherty silt loam or very cherty silty clay loam. The 2Bt horizon has hue of 10YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is silty clay or clay.

Razort Series

The Razort series consists of very deep, well drained, moderately permeable soils on flood plains. These soils formed in silty and loamy alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Razort silt loam, 0 to 3 percent slopes, 1,700 feet south and 2,000 feet west of the northeast corner of sec. 31, T. 39 N., R. 18 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many fine roots; medium acid; clear smooth boundary.

BA—7 to 12 inches; brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4) dry; common medium faint dark yellowish brown (10YR 3/4) mottles; weak fine subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.

Bt1—12 to 18 inches; brown (7.5YR 4/4) silt loam; common medium distinct dark brown (10YR 3/3) mottles; weak very fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—18 to 26 inches; brown (7.5YR 4/4) clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; few very dark grayish brown stains; strongly acid; clear smooth boundary.

Bt3—26 to 48 inches; brown (7.5YR 4/4) gravelly silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 20 percent coarse fragments; medium acid; clear smooth boundary.

Bt4—48 to 60 inches; brown (7.5YR 4/4) very gravelly clay loam; common medium distinct dark reddish brown (5YR 3/4) mottles; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; about 40 percent coarse fragments; medium acid.

The Ap or A horizon has value of 2 or 3 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It is silt loam, loam, clay loam, or the cherty or very cherty analogs of those textures.

Viraton Series

The Viraton series consists of very deep, moderately well drained soils on uplands. These soils have a fragipan. Permeability is moderate above the fragipan, very slow in the fragipan, and moderately slow below the fragipan. The soils formed in loess or loamy sediments and in cherty dolomite residuum. Slopes range from 3 to 9 percent.

Typical pedon of Viraton silt loam, 3 to 9 percent slopes, 1,330 feet north and 1,200 feet east of the southwest corner of sec. 5, T. 37 N., R. 15 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; about 5 percent chert fragments; slightly acid; clear smooth boundary.

Bt1—5 to 9 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint dark brown (10YR 4/3) and common fine prominent strong brown (7.5YR 5/6) mottles; weak very fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—9 to 16 inches; strong brown (7.5YR 5/6) cherty silty clay loam; common fine prominent yellowish brown (10YR 5/4) and red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; about 20 percent chert fragments; very strongly acid; clear smooth boundary.

Bt3—16 to 19 inches; pale brown (10YR 6/3) cherty silty clay loam; common fine faint grayish brown (10YR 5/2), many medium distinct yellowish brown (10YR 5/6), and few fine prominent red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; about 30 percent chert fragments; very strongly acid; clear smooth boundary.

2Bx—19 to 30 inches; light brownish gray (10YR 6/2) extremely cherty silt loam; many fine distinct yellowish brown (10YR 5/4) and common fine prominent yellowish red (5YR 4/6) mottles; weak

thick platy structure parting to weak fine subangular blocky; brittle; very firm; about 65 percent chert fragments; extremely acid; gradual smooth boundary.

3Bt1—30 to 42 inches; dark red (2.5YR 3/6) cherty clay; many fine prominent grayish brown (10YR 5/2) and common fine faint red (2.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; common faint clay films on faces of peds; about 20 percent chert fragments; very strongly acid; gradual smooth boundary.

3Bt2—42 to 60 inches; red (2.5YR 4/6) clay; common fine faint dark red (2.5YR 3/6) and common fine prominent grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; firm; common faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid.

Depth to the fragipan ranges from 18 to 33 inches.

The Ap or A horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has value of 4 to 6 and chroma of 3 to 6. It is silt loam or silty clay loam or the cherty or very cherty analogs of those textures. The 2Bx horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 2 to 6. It is mottled in shades of red, gray, and brown. The 3Bt horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 3 to 8. It is silty clay or clay or the cherty, very cherty, or extremely cherty analogs of those textures.

Formation of the Soils

This section relates the major factors of soil formation to the soils in Camden County. It also describes the geology, physiography, and hydrology of the county.

Factors of Soil Formation

Soils are continually changing. The characteristics of a soil at any given point are determined by the physical and mineralogical composition of the parent material; the plant and animal life on and in the soil; the climate under which the soil material accumulated and has existed since accumulation; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Plant and animal life, chiefly plants, are active in soil formation. The climate determines the amount of water available for leaching and the amount of heat available for physical and chemical changes. Together, climate and plant and animal life act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. Relief often modifies these other factors. Finally, time is required for the transformation of the parent material into soil. Generally, a long time is required for the development of distinct soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others. Soil formation is complex, and many processes of soil development are still unknown.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineral composition of the soil. The soils in Camden County formed in residual material, cherty sediments, loess over residuum, and alluvium or in a combination of these materials.

Residual material in Camden County consists primarily of material weathered from cherty dolomite, dolomite, and sandstone. Bardley, Gasconade, Gatewood, and Gepp soils formed in residuum.

Cherty sediments are lag concentrations of chert and finer sediments associated with an erosional surface. On the steeper slopes, this material is the surface layer of the present soil. Clarksville, Doniphan, Niangua, and Poynor soils formed in cherty sediments and in the underlying cherty dolomite and sandstone residuum.

Loess is silty material deposited by the wind. Most of the uplands in the survey area have deposits of loess or have had them in the past. The loess has been eroded from or mixed with the surface layer on the steep side slopes. Only the more stable ridgetops and a few areas of gently sloping to moderately sloping head slopes have loess caps now ranging from about 18 to 30 inches thick. Gunlock, Lebanon, Plato, and Viraton soils formed in this loess and in the underlying cherty sediments and material weathered from cherty dolomite.

Alluvium is material transported by water and deposited on the nearly level or gently sloping flood plains along streams and rivers. The major streams in Camden County are the Niangua, Little Niangua, and Wet Glaize Rivers. The flood plain along the Osage River has been inundated by the creation of the Lake of the Ozarks. The alluvial material was washed from the watersheds of these rivers and streams and their tributaries. It ranges from silt to sand and gravel. Kaintuck soils formed in sandy material, Huntington and Nolin soils formed in silty material, and Cedargap soils formed in silty material that has a high content of chert.

Stream terraces are former flood plains that were abandoned because of the downcutting of stream channels to a lower elevation. The alluvial material on these terraces is clayey, silty, or loamy. Hartville, Moniteau, and Razort soils formed on these stream terraces.

Plant and Animal Life

Living organisms on and in the soil have contributed to the alteration of the parent material and the properties of the soil. Plants, bacteria and fungi,

burrowing animals, and human activities have had varying impacts on soil formation. They have influenced the content of organic matter and nitrogen, reaction, color, thickness and kinds of horizons, structure, aeration, and other soil properties.

Plants greatly influence soil formation. Throughout time, plant communities have varied depending on soil fertility, available water capacity, drainage, and depth. Most of the soils in the survey area formed under forest vegetation. They had a high accumulation of organic matter on or near the surface. When the soil was cleared for farming, this organic layer was mixed with the plow layer and was soon oxidized. Therefore, cultivated soils that were previously forested have a gray or light brown surface layer that has a very low content of organic matter.

Worms, insects, burrowing animals, and large animals affect and disturb the soils. Bacteria and fungi contribute more toward the formation of soils than do animals. They play an important part in the decay and decomposition of organic material. They also improve tilth and fix nitrogen in the soils. The population of soil organisms is directly related to the rate of decomposition of organic material in the soil. The kinds of organisms in a given area and their activity are determined by differences in vegetation.

Intensive cultivation, the clearing of trees, and other human activities also influence soil formation. In some areas cultivation has mixed the surface layer with the subsurface layer, reduced the organic matter content, inhibited biological activity in the soil, and decreased the stability of soil structure, and in many areas it has removed the original surface layer, thereby lowering the fertility and productivity of the soil. The introduction of new crops and applications of chemicals, such as fertilizer and lime, also have affected soil formation.

Climate

Climate has been an important factor in the formation of the soils in Camden County. Rainfall and temperature continue to affect soil formation. The rate of geologic erosion varies with the climate and influences the shape and character of the landforms in an area. Changes in the relative abundance and species composition of plant and animal life are directed by climatic change.

The higher temperatures and amounts of rainfall in Camden County encourage rapid chemical change and physical disintegration of the soil. When calcium carbonate and other soluble salts are removed by leaching, soil fertility deteriorates. The climate of the county also favors the relatively rapid breakdown of minerals and the resulting formation of clay. It also favors the translocation of clay downward through the soil profile into the subsoil. This process is known as illuviation. These effects are evident in nearly all of the soils in the uplands, including Doniphan, Clarksville, and Poynor soils.

Local conditions can modify the influence of the climate in a region. Variations in temperature from high to low elevations have had only a slight influence on soil development. The effects of temperature differences resulting from aspect are more evident. For example, south- and west-facing slopes are warmer and dryer than north- and east-facing slopes. Shallower soils and inferior tree species and slower growth of trees are evident on the warmer and dryer south- and west-facing slopes.

Relief

Relief is characterized by gradient, or percent of slope, and by the length, shape, aspect, and uniformity of the slopes that make up a landscape. It affects soil formation mostly through its influence on drainage, runoff, and erosion.

Relief results from natural forces that create inequities in land surfaces. The steep, dissected topography of Camden County is a result of the deep, meandering entrenchment of the Osage and Niangua Rivers and their tributaries. The divide between the valleys of the Osage and Gasconade Rivers runs southwest to northeast and passes through Stoutland and Richland along a portion of the southeastern Camden County line. Therefore, the direction of flow throughout the county is generally northward toward the Osage River.

Relief affects soil formation through its influence on climate, erosion, and water movement within the landscape. The length, shape, and gradient of the slope affect soil-water relationships. The steepness of slope influences the amount of runoff, the rate of water infiltration, leaching rates, translocation of clay, thickness of the solum, and soil temperature. Soil temperature is also affected by aspect. Position on the landscape affects water movement and amounts of moisture. Gently sloping uplands absorb a considerable amount of moisture, the steeper side slopes generate a high percentage of runoff, and the lower side slopes receive runoff from adjoining areas in addition to direct rainfall.

Time

Time allows living organisms, climate, and relief to exert their influence on parent material. The degree to which soil-forming processes have changed the parent material determines the age of a soil.

Nolin and Huntington soils, which formed in alluvium

deposited by floodwater receding from the major streams, are examples of the youngest soils in the survey area. The oldest soils formed in nearly level or gently sloping areas at the highest elevations in the county. Lebanon and Plato soils are examples. They have well developed, distinct horizons. The carbonates originally present in their parent material have been leached to a great depth, leaving the soils quite acid throughout. Clay has been concentrated in distinct subsoil horizons through translocation by water, and thus these soils have a distinct fragipan. Although the genesis of the fragipan is obscure *(11)*, it is clear that some time is required for its formation.

Most of the soils in Camden County are intermediate in age. Clarksville and Niangua soils formed in cherty sediments and the underlying dolomite or limestone residuum on steep side slopes in the uplands. They have an eluviated subsurface horizon and translocated clay in the subsoil horizons.

The age of a soil, as expressed in profile characteristics, is not necessarily a reflection of time in years but is rather a result of the interaction of various soil-forming factors over periods of time. The age is influenced by topography and climate. It is determined by the degree of profile development and not by the years that the soil material has existed.

Geology, Physiography, and Hydrology

John W. Whitfield, geologist, Engineering Geology Section, Geology and Land Survey, Missouri Department of Natural Resources, helped prepare this section.

Camden County is on the Salem Plateau, a subprovince of the Ozark Province. The landscape varies from steeply sloping wooded hills and narrow, stony valleys in the Lake of the Ozarks region to gently rolling, prairielike uplands in southeastern Camden County. Bedrock consists of dolomite, cherty dolomite, and sandstone of Cambrian and Ordovician age.

There are several old and inactive geologic faults that pass through Camden County. One of the most prominent is the Red Arrow fault, which runs from northwest to southeast across central Camden County. Highway 54 crosses the Red Arrow fault approximately one-fourth mile west of the Niangua Arm Bridge. The steeply dipping bedrock exposed in the roadcut is an example of fault displacement.

Because of the effects of weathering, the bedrock surface is uneven. The depth to bedrock ranges from less than a foot on glades and rocky slopes to over 50 feet in areas where weathering has been severe.

Precambrian granites and gneiss are from 1,200 to 1,600 feet below the surface, but some small outcrops of Precambrian rock are in the Decaturville structure, which lies at the southern edge of the county on the Camden-Laclede County line. The Decaturville structure is circular and is several miles in diameter. It contains highly faulted and brecciated bedrock. In the uplifted center is a small outcrop of Precambrian pegmatite, some of it brecciated, composed of mica, quartz, tourmaline, and feldspar. Opinions vary concerning the origin of the structure. Detailed geological studies support either meteorite impact or cryptoexplosive activity as possible explanations.

From oldest to youngest, the geologic formations that crop out in Camden County are the Eminence Dolomite, Gasconade Dolomite, Roubidoux Formation, and Jefferson City Dolomite. The thickness of the bedrock varies according to the extent of erosion and weathering.

Eminence Dolomite is 300 to 350 feet thick. It consists of gray to light brown dolomite that has thin beds of chert. Druse, a particular type of chert, is common in small cavities in the dolomite. Eminence Dolomite is exposed only along the southern part of the Lake of the Ozarks, primarily along the Niangua Arm.

Gasconade Dolomite is 290 to 330 feet thick. It is composed of light brown to gray dolomite that has thin to massive layers of chert. The formation can be divided into two units. The upper unit is 40 to 60 feet thick. It consists of massive beds of coarse grained dolomite and small amounts of white chert. A distinct layer of cryptozoon chert that is 2 to 4 feet thick separates the upper unit from the lower unit. It is hard and ranges from white to blue-gray and appears gnarled. The lower unit is very cherty. It consists of thin to medium beds of dolomite interbedded with cherty layers and nodules. Outcrops of Gasconade Dolomite form high bluffs along the lake and in other parts of the county.

The *Gunter Sandstone Member,* a sandstone unit, forms the base of the Gasconade. It is 15 to 20 feet thick. It is composed of thinly bedded sandstone that is visible as small bluffs or as a series of large boulders. The Gunter is mainly exposed on hillsides bordering the Niangua Arm.

The *Roubidoux Formation* generally is 130 to 150 feet thick. The upper part is commonly weathered and eroded; therefore, the thickness of the formation varies. The formation is made up of cherty dolomite, chert, and sandstone. Parts of the formation are composed almost entirely of hard, brittle layers of chert. Each layer is several feet thick. The Roubidoux Formation in Camden County has less sandstone than it does in the counties to the south. Outcrops frequently develop a ragged, dirty appearance because of the effects of weathering on reddish, stained layers of chert, dolomite, and quartzose sandstone.

Jefferson City Dolomite ranges from less than 10 feet

to more than 100 feet in thickness. It consists of silty to crystalline dolomite with thin to medium beds of chert and an occasional thin layer of sandstone. The upper part of the Jefferson City Dolomite is commonly weathered and eroded; therefore, the depth to bedrock and the thickness of residuum vary. Many of the glades on uplands in Camden County are in areas of the Jefferson City Dolomite.

All bedrock units yield water to some degree. Wells drilled for private water supplies are typically 150 to 400 feet deep and yield 10 to 15 gallons per minute. Wells drilled for public water supplies are generally 500 to 1,000 feet deep and yield as much as 250 gallons per minute.

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(12) University of Missouri Extension Office of Social and Economic Data Analysis. 1989. Social and economic profile, Camden County. 23 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded

fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Dolomite. A magnesia-rich sedimentary rock resembling limestone.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly

pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to

be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Limestone. A shaly or sandy sedimentary rock, chiefly CaCO3, containing variable quantities of magnesium carbonate and quartz.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Very gently sloping	1 to 4 percent
Gently sloping	2 to 5 percent
Moderately sloping	5 to 9 percent
Strongly sloping	9 to 14 percent
Moderately steep	14 to 20 percent
Steep	20 to 35 percent
Very steep	35 to 100 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the

next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-87 at Camdenton, Missouri)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	42.8	20.5	31.7	71	1	15	1.61	0.57	2.46	4	5.7
February----	49.1	26.0	37.6	77	1	25	2.36	1.02	3.50	5	4.7
March-------	58.4	33.8	46.1	85	7	107	3.49	1.87	4.90	7	3.7
April-------	71.8	45.8	58.8	91	24	282	3.85	2.50	5.06	7	.2
May---------	78.4	54.5	66.5	90	34	512	4.96	2.94	6.76	8	.0
June--------	85.8	63.1	74.5	97	46	735	4.35	2.03	6.33	7	.0
July--------	91.1	67.4	79.3	103	52	908	3.64	1.24	5.61	6	.0
August------	90.2	65.6	77.9	103	50	865	3.69	1.72	5.38	5	.0
September---	82.9	58.0	70.5	98	36	615	4.34	2.02	6.33	6	.0
October-----	72.2	46.9	59.6	90	25	310	4.28	1.86	6.35	6	.0
November----	57.8	35.4	46.6	80	11	53	3.03	1.18	4.57	5	1.4
December----	46.5	25.9	36.2	72	11	20	2.72	1.29	3.96	5	3.7
Yearly:											
Average---	68.9	45.2	57.1	---	---	---	---	---	---	---	---
Extreme---	---	---	---	104	11	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,447	42.32	35.43	49.27	71	19.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-87 at Camdenton, Missouri)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 3	Apr. 19	Apr. 30
2 years in 10 later than--	Mar. 29	Apr. 14	Apr. 24
5 years in 10 later than--	Mar. 21	Apr. 4	Apr. 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 27	Oct. 15	Oct. 2
2 years in 10 earlier than--	Nov. 1	Oct. 20	Oct. 8
5 years in 10 earlier than--	Nov. 10	Oct. 31	Oct. 19

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-87 at Camdenton, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	212	187	167
8 years in 10	220	195	174
5 years in 10	234	210	188
2 years in 10	247	225	202
1 year in 10	255	233	209

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
11D	Bardley-Gasconade complex, 5 to 14 percent slopes	9,200	2.0
12A	Cedargap cherty silt loam, clayey substratum, 0 to 3 percent slopes	18,400	4.1
13A	Cedargap silt loam, 0 to 3 percent slopes	2,250	0.5
14B	Peridge silt loam, 2 to 5 percent slopes	260	0.1
14C	Peridge silt loam, 5 to 9 percent slopes	4,650	1.0
16D	Clarksville very cherty silt loam, 9 to 14 percent slopes	10,400	2.3
20C	Doniphan very cherty silt loam, 3 to 9 percent slopes	75,000	16.6
22E	Gasconade-Rock outcrop complex, 5 to 20 percent slopes	6,800	1.5
26	Moniteau silt loam	620	0.1
29	Nolin silt loam	5,200	1.1
30A	Kaintuck loam, 0 to 3 percent slopes	340	0.1
31A	Razort silt loam, 0 to 3 percent slopes	1,900	0.4
32C	Viraton silt loam, 3 to 9 percent slopes	15,300	3.4
33F	Knobby-Rock outcrop complex, 20 to 50 percent slopes	1,950	0.4
34C	Gatewood cherty silt loam, 5 to 9 percent slopes	9,700	2.1
34D	Gatewood cherty silt loam, 9 to 14 percent slopes	14,400	3.2
35B	Lebanon silt loam, 2 to 5 percent slopes	34,500	7.6
37B	Hartville silt loam, 2 to 5 percent slopes	580	0.1
38	Riverwash	270	0.1
40	Huntington silt loam	1,650	0.4
41B	Plato silt loam, 1 to 4 percent slopes	830	0.2
42C	Gunlock silt loam, 3 to 9 percent slopes	4,150	0.9
43F	Poynor very cherty silt loam, 14 to 35 percent slopes	1,600	0.4
46F	Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes, stony	55,500	12.2
47F	Niangua-Bardley very cherty silt loams, 14 to 50 percent slopes, very stony	131,972	29.1
48G	Rock outcrop-Bardley complex, 35 to 99 percent slopes	2,850	0.6
	Water areas more than 40 acres in size	42,944	9.5
	Total	453,216	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
13A	Cedargap silt loam, 0 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
14B	Peridge silt loam, 2 to 5 percent slopes
26	Moniteau silt loam (where drained)
29	Nolin silt loam
30A	Kaintuck loam, 0 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
31A	Razort silt loam, 0 to 3 percent slopes
35B	Lebanon silt loam, 2 to 5 percent slopes
37B	Hartville silt loam, 2 to 5 percent slopes
40	Huntington silt loam (where protected from flooding or not frequently flooded during the growing season)
41B	Plato silt loam, 1 to 4 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Soybeans	Grain sorghum	Winter wheat	Tall fescue	Tall fescue-red clover hay	Switchgrass
		Bu	Bu	Bu	AUM*	Tons	AUM*
11D------------- Bardley- Gasconade	VIIe	---	---	---	1.0	---	1.0
12A------------- Cedargap	IIIw	22	53	25	3.4	2.3	4.0
13A------------- Cedargap	IIIw	---	---	---	3.2	2.0	3.6
14B------------- Peridge	IIe	41	94	46	6.1	4.0	6.2
14C------------- Peridge	IIIe	37	88	41	5.6	3.7	6.0
16D------------- Clarksville	VIe	---	---	---	2.3	1.7	2.3
20C------------- Doniphan	IVe	---	---	25	3.4	2.3	4.0
22E**----------- Gasconade-Rock outcrop	VIIs	---	---	---	---	---	---
26-------------- Moniteau	IIIw	37	88	41	5.6	3.7	6.0
29-------------- Nolin	IIw	41	95	50	6.2	4.1	6.4
30A------------- Kaintuck	IIIw	25	65	30	4.1	2.8	4.8
31A------------- Razort	IIe	40	90	44	6.0	4.0	6.1
32C------------- Viraton	IIIe	27	65	30	4.1	2.8	4.8
33F**----------- Knobby-Rock outcrop	VIIs	---	---	---	---	---	---
34C------------- Gatewood	IVe	---	---	18	2.3	1.5	2.8
34D------------- Gatewood	VIe	---	---	---	2.0	---	2.0
35B------------- Lebanon	IIe	30	71	35	4.5	3.0	5.0
37B------------- Hartville	IIe	36	85	40	5.3	3.5	5.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Soybeans	Grain sorghum	Winter wheat	Tall fescue	Tall fescue-red clover hay	Switchgrass
		Bu	Bu	Bu	AUM*	Tons	AUM*
38**. Riverwash							
40-------------- Huntington	IIw	36	85	40	5.4	3.6	5.9
41B------------- Plato	IIe	23	59	27	3.8	2.5	4.2
42C------------- Gunlock	IIIe	22	56	26	3.6	2.4	4.1
43F------------- Poynor	VIIe	---	---	---	1.5	---	1.5
46F------------- Clarksville-Gepp	VIIe	---	---	---	1.5	---	1.5
47F------------- Niangua-Bardley	VIIe	---	---	---	1.0	---	1.0
48G------------- Rock outcrop-Bardley	VIII	---	---	---	---	---	---

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
11D**:									
Bardley	2D	Slight	Slight	Slight	Moderate	Post oak	45	30	Shortleaf pine, eastern redcedar, white oak, black oak.
Gasconade	2D	Slight	Moderate	Severe	Severe	Chinkapin oak	40	26	Eastern redcedar, shortleaf pine.
						Eastern redcedar	30	32	
						White ash	---	---	
						Post oak	---	---	
						Blackjack oak	---	---	
						Northern red oak	---	---	
12A Cedargap	3F	Slight	Slight	Slight	Slight	Black oak	66	48	Black oak, shortleaf pine.
13A Cedargap	3A	Slight	Slight	Slight	Slight	Black oak	66	48	Black oak, shortleaf pine.
14B, 14C Peridge	4A	Slight	Slight	Slight	Slight	Northern red oak	70	52	Black walnut, northern red oak, white oak.
						Black walnut	---	---	
						White oak	---	---	
16D Clarksville	3F	Slight	Slight	Moderate	Slight	White oak	55	41	White oak, yellow-poplar, northern red oak.
						Black oak	62	44	
						Northern red oak	58	44	
20C Doniphan	3F	Slight	Moderate	Moderate	Slight	Black oak	62	46	White oak, sweetgum, yellow-poplar, northern red oak.
						White oak	58	42	
						Northern red oak	61	44	
22E**:									
Gasconade	2D	Slight	Moderate	Moderate	Severe	Chinkapin oak	40	26	Eastern redcedar, shortleaf pine.
						Eastern redcedar	30	32	
						White ash	---	---	
						Post oak	---	---	
						Blackjack oak	---	---	
Rock outcrop.									
26 Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak	70	52	Pin oak, green ash, eastern cottonwood, silver maple, sweetgum.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
29-------------- Nolin	11A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Black walnut-------- American sycamore--- River birch---------	108 --- --- ---	150 --- --- ---	Yellow-poplar, eastern cottonwood, white ash, black walnut.
30A------------- Kaintuck	7W	Slight	Moderate	Slight	Slight	American sycamore--- White oak----------- Northern red oak---- River birch--------- American basswood--- Black walnut--------	90 --- --- --- --- ---	98 --- --- --- --- ---	Black walnut, northern red oak, American sycamore, green ash.
31A------------- Razort	9A	Slight	Slight	Slight	Slight	Northern red oak---- Eastern cottonwood-- American sycamore--- White oak-----------	80 90 85 75	62 103 88 57	Northern red oak, American sycamore, white oak, black walnut.
32C------------- Viraton	3D	Slight	Slight	Moderate	Moderate	White oak----------- Black oak-----------	52 62	38 43	White oak, black oak.
33F**:									
Knobby---------	2F	Moderate	Severe	Severe	Severe	Eastern redcedar----	25	2	Eastern redcedar.
Rock outcrop.									
34C, 34D-------- Gatewood	2A	Slight	Slight	Slight	Slight	White oak----------- Eastern redcedar---- Post oak------------ Black oak-----------	45 40 43 42	30 43 28 28	Shortleaf pine, black oak.
35B------------- Lebanon	3D	Slight	Slight	Slight	Moderate	White oak----------- Black oak-----------	55 60	38 43	Shortleaf pine, black oak.
37B------------- Hartville	3C	Slight	Slight	Severe	Severe	White oak-----------	55	38	Yellow-poplar, white oak, pin oak.
40-------------- Huntington	9A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Yellow-poplar------- Northern red oak----	100 95 85	128 100 67	Yellow-poplar, black walnut, northern red oak.
41B------------- Plato	3D	Slight	Slight	Slight	Moderate	White oak----------- Black oak-----------	55 60	38 43	Shortleaf pine, post oak, black oak.
42C------------- Gunlock	3A	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- Black oak-----------	60 57 60	43 40 43	Northern red oak, white oak, black oak.
43F------------- Poynor	3R	Moderate	Moderate	Moderate	Slight	Black oak----------- White oak----------- Shortleaf pine------	53 48 55	41 78 46	Black oak, shortleaf pine.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
46F**:									
Clarksville----	3R	Moderate	Severe	Moderate	Slight	White oak-----------	55	41	White oak, northern red oak.
						Shortleaf pine------	61	44	
						Black oak-----------	62	44	
						Northern red oak----	58	44	
						Post oak------------	---	---	
Gepp-----------	3R	Moderate	Moderate	Moderate	Slight	White oak-----------	60	43	Northern red oak, shortleaf pine.
						Black oak-----------	65	52	
						Northern red oak----	60	43	
						Post oak------------	---	---	
47F**:									
Niangua--------	3R	Moderate	Moderate	Moderate	Slight	White oak-----------	54	38	Northern red oak, shortleaf pine.
						Black oak-----------	56	39	
						Northern red oak----	---	---	
						Mockernut hickory---	---	---	
						Bitternut hickory---	---	---	
						Shagbark hickory----	---	---	
Bardley--------	2R	Moderate	Moderate	Moderate	Moderate	Post oak------------	45	30	Shortleaf pine, black oak.
						Black oak-----------	54	38	
48G**:									
Rock outcrop.									
Bardley--------	2R	Severe	Severe	Slight	Moderate	Post oak------------	45	30	Shortleaf pine, eastern redcedar, black oak.
						Black oak-----------	54	38	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
11D*:					
Bardley	Lilac, fragrant sumac, Amur honeysuckle.	Autumn-olive	Russian-olive, hackberry, eastern redcedar, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---
Gasconade.					
12A Cedargap	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Hackberry, eastern white pine, Austrian pine, green ash, honeylocust, pin oak, Douglas-fir.	Eastern cottonwood.
13A Cedargap	---	Amur maple, Amur honeysuckle, autumn-olive, lilac.	Eastern redcedar	Hackberry, Austrian pine, eastern white pine, green ash, honeylocust, pin oak, Douglas-fir.	Eastern cottonwood.
14B, 14C Peridge	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar, Russian-olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---
16D Clarksville	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
20C Doniphan	Amur honeysuckle, lilac.	Autumn-olive	Austrian pine, honeylocust, eastern redcedar, hackberry, green ash, bur oak, Russian-olive.	Siberian elm	---
22E*:					
Gasconade.					
Rock outcrop.					
26 Moniteau	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Norway spruce, green ash, golden willow, honeylocust, northern red oak, silver maple.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
29. Nolin	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern whitecedar, white fir, Austrian pine.	Norway spruce, Douglas-fir.	Pin oak, eastern white pine.
30A. Kaintuck	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Eastern redcedar	Austrian pine, eastern white pine, hackberry, green ash, honeylocust, pin oak, Douglas-fir.	Eastern cottonwood.
31A. Razort	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Austrian pine, pin oak, green ash, hackberry, honeylocust, eastern white pine.	Eastern cottonwood.
32C. Viraton	Lilac	Manchurian crabapple, Amur honeysuckle, Amur maple, autumn-olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian-olive.	Honeylocust	---
33F*: Knobby.					
Rock outcrop.					
34C, 34D. Gatewood	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive	Russian-olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
35B. Lebanon	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Austrian pine, eastern redcedar, green ash, Russian-olive, hackberry.	Honeylocust	---
37B. Hartville	Lilac	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Austrian pine, hackberry, green ash, Russian-olive, eastern redcedar.	Honeylocust	---
38*. Riverwash					
40. Huntington	---	Amur honeysuckle, lilac, Amur maple, autumn-olive.	Eastern redcedar	Austrian pine, hackberry, green ash, pin oak, honeylocust, eastern white pine.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
41B---------------- Plato	Lilac-------------	Amur honeysuckle, Amur maple, autumn-olive, Manchurian crabapple.	Russian-olive, Austrian pine, eastern redcedar, hackberry, green ash.	Honeylocust-------	---
42C---------------- Gunlock	---	Amur honeysuckle, Amur maple, autumn-olive, lilac.	Eastern redcedar, hackberry, Russian-olive.	Eastern white pine, Norway spruce, green ash, honeylocust, pin oak, Douglas-fir.	---
43F---------------- Poynor	Siberian peashrub	Amur honeysuckle, eastern redcedar, autumn-olive, radiant crabapple, Washington hawthorn, lilac.	Eastern white pine, Austrian pine, red pine.	---	---
46F*:					
Clarksville------	Amur honeysuckle, lilac, fragrant sumac.	Autumn-olive------	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian-olive.	Siberian elm------	---
Gepp-------------	Lilac, Amur honeysuckle, fragrant sumac.	Autumn-olive------	Russian-olive, green ash, honeylocust, bur oak, eastern redcedar, hackberry, Austrian pine.	Siberian elm------	---
47F*:					
Niangua----------	Amur honeysuckle, fragrant sumac, lilac.	Autumn-olive------	Russian-olive, Austrian pine, eastern redcedar, bur oak, hackberry, green ash, honeylocust.	Siberian elm------	---
Bardley----------	Lilac, fragrant sumac, Amur honeysuckle.	Autumn-olive------	Russian-olive, hackberry, eastern redcedar, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm------	---
48G*: Rock outcrop.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
48G*:					
Bardley----------	Lilac, fragrant sumac, Amur honeysuckle.	Autumn-olive------	Russian-olive, hackberry, eastern redcedar, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm------	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
11D*:					
Bardley	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight	Moderate: small stones.
Gasconade	Severe: thin layer.	Severe: thin layer.	Severe: large stones, slope, thin layer.	Moderate: large stones.	Severe: large stones, thin layer.
12A Cedargap	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones, flooding.	Severe: small stones.	Severe: small stones, flooding.
13A Cedargap	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
14B Peridge	Slight	Slight	Moderate: slope.	Slight	Slight.
14C Peridge	Slight	Slight	Severe: slope.	Slight	Slight.
16D Clarksville	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
20C Doniphan	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: large stones.	Severe: small stones.
22E*:					
Gasconade	Severe: thin layer.	Severe: thin layer.	Severe: slope, small stones.	Slight	Severe: thin layer.
Rock outcrop.					
26 Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
29 Nolin	Severe: flooding.	Slight	Slight	Severe: erodes easily.	Moderate: flooding.
30A Kaintuck	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
31A Razort	Severe: flooding.	Slight	Moderate: small stones.	Slight	Slight.
32C Viraton	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
33F*:					
Knobby	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Severe: slope.	Severe: droughty, slope, thin layer.
Rock outcrop.					
34C Gatewood	Moderate: large stones.	Moderate: large stones.	Severe: slope, large stones.	Slight	Moderate: small stones.
34D Gatewood	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Slight	Moderate: small stones.
35B Lebanon	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
37B Hartville	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
38*: Riverwash					
40 Huntington	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
41B Plato	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
42C Gunlock	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Slight.
43F Poynor	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope, droughty.
46F*:					
Clarksville	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
Gepp	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: large stones, slope.
47F*:					
Niangua	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
47F*:					
Bardley	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
48G*:					
Rock outcrop.					
Bardley	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
11D*:										
Bardley	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
12A, 13A Cedargap	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
14B Peridge	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
14C Peridge	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
16D Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
20C Doniphan	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
22E*:										
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
26 Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
29 Nolin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
30A Kaintuck	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
31A Razort	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
32C Viraton	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
33F*:										
Knobby	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.										
34C, 34D Gatewood	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
35B Lebanon	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
37B Hartville	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
38*. Riverwash										
40 Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
41B Plato	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
42C Gunlock	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
43F Poynor	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
46F*:										
Clarksville	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Gepp	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47F*:										
Niangua	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Bardley	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
48G*:										
Rock outcrop.										
Bardley	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
11D*:						
Bardley	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: small stones.
Gasconade	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Severe large stones, thin layer.
12A Cedargap	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, flooding.
13A Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
14B Peridge	Moderate: too clayey.	Slight	Slight	Slight	Severe: low strength.	Slight.
14C Peridge	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
16D Clarksville	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Severe: small stones.
20C Doniphan	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: small stones.
22E*:						
Gasconade	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
Rock outcrop.						
26 Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
29 Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
30A Kaintuck	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
31A Razort	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
32C--------------- Viraton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: wetness.
33F*:						
Knobby-----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: droughty, slope, thin layer.
Rock outcrop.						
34C--------------- Gatewood	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: small stones.
34D--------------- Gatewood	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: small stones.
35B--------------- Lebanon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.
37B--------------- Hartville	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
38*. Riverwash						
40---------------- Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
41B--------------- Plato	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.
42C--------------- Gunlock	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.
43F--------------- Poynor	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope, droughty.
46F*:						
Clarksville------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Gepp-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: large stones, slope.
47F*:						
Niangua----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47F*:						
Bardley----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
48G*:						
Rock outcrop.						
Bardley----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11D*:					
Bardley	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
Gasconade	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, too clayey, large stones.
12A Cedargap	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, small stones.
13A Cedargap	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: small stones.
14B Peridge	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
14C Peridge	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
16D Clarksville	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too clayey.	Severe: seepage.	Poor: small stones.
20C Doniphan	Moderate: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
22E*:					
Gasconade	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, too clayey, small stones.
Rock outcrop.					
26 Moniteau	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
29 Nolin	Severe: flooding, wetness.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
30A Kaintuck	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
31A-----------------Razort	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Fair: too clayey, small stones.
32C-----------------Viraton	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
33F*:					
Knobby--------------	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, slope, thin layer.
Rock outcrop.					
34C-----------------Gatewood	Severe: thin layer, seepage, percs slowly.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
34D-----------------Gatewood	Severe: thin layer, seepage, percs slowly.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage.	Moderate: seepage, slope.	Poor: area reclaim, too clayey, hard to pack.
35B-----------------Lebanon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, small stones.
37B-----------------Hartville	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
38*. Riverwash					
40------------------Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
41B-----------------Plato	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
42C-----------------Gunlock	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Poor: small stones.
43F-----------------Poynor	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
46F*:					
Clarksville--------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
46F*:					
Gepp	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
47F*:					
Niangua	Severe: slope, percs slowly.	Severe: slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
Bardley	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
48G*:					
Rock outcrop.					
Bardley	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS

Soil name and map symbol	Limitations	Soil potential and corrective measures	Continuing limitations
11D*:			
Bardley	Thin layer, seepage.	Low: Low-pressure pipe system or other alternative system, large absorption field, land shaping.	Surfacing of effluent, contamination of ground water.
Gasconade	Thin layer, seepage.	Very low: No known corrective measures.	Surfacing of effluent, contamination of ground water.
12A, 13A: Cedargap	Flooding, percs slowly.	Very low: No known corrective measures.	Contamination of streams.
14B: Peridge	Percs slowly	High: No corrective measures needed.	None.
14C: Peridge	Percs slowly	High: Interceptor drains.	Maintenance of drains.
16D: Clarksville	Slope	Medium: Interceptor drains, land shaping.	Surfacing of effluent.
20C: Doniphan	Percs slowly	High: Interceptor drains, land shaping.	Surfacing of effluent.
22E: Gasconade	Thin layer, seepage.	Very low: No known corrective measures.	Surfacing of effluent, contamination of ground water.
Rock outcrop.			
26: Moniteau	Wetness, percs slowly.	Very low: No known corrective measures.	Contamination of streams.
29: Nolin	Flooding, wetness.	Very low: No known corrective measures.	Contamination of streams.
30A: Kaintuck	Flooding	Very low: No known corrective measures.	Contamination of streams.
31A: Razort	Flooding, percs slowly.	Low: No known corrective measures.	Contamination of streams.
32C: Viraton	Percs slowly, wetness, slope.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains, land shaping.	Surfacing of effluent.
33F: Knobby	Thin layer, seepage, slope.	Very low: No known corrective measures.	Contamination of ground water.
Rock outcrop.			

See footnote at end of table.

TABLE 13.--SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS--Continued

Soil name and map symbol	Limitations	Soil potential and corrective measures	Continuing limitations
34C---------------- Gatewood	Thin layer, percs slowly, seepage, slope.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains, land shaping.	Surfacing of effluent, contamination of ground water.
34D---------------- Gatewood	Thin layer, percs slowly, seepage, slope.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains, land shaping.	Surfacing of effluent, contamination of ground water.
35B---------------- Lebanon	Percs slowly, wetness.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains.	Surfacing of effluent.
37B---------------- Hartville	Percs slowly, wetness.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains.	Surfacing of effluent.
38----------------- Riverwash	Flooding-----------	Very low: No known corrective measures.	Contamination of streams.
40----------------- Huntington	Flooding-----------	Very low: No known corrective measures.	Contamination of streams.
41B---------------- Plato	Percs slowly, wetness.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains, land shaping.	Surfacing of effluent.
42C---------------- Gunlock	Percs slowly, wetness.	Medium: Low-pressure pipe system or other alternative system, large absorption field, interceptor drains, land shaping.	Surfacing of effluent.
43F---------------- Poynor	Slope--------------	Medium: Special design to overcome slope, interceptor drains, land shaping.	Surfacing of effluent.
46F*:			
Clarksville-------	Slope--------------	Medium: Special design to overcome slope, interceptor drains, land shaping.	Surfacing of effluent.
Gepp--------------	Slope--------------	Medium: Special design to overcome slope, interceptor drains, land shaping.	Surfacing of effluent.

See footnote at end of table.

TABLE 13.--SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS--Continued

Soil name and map symbol	Limitations	Soil potential and corrective measures	Continuing limitations
47F*:			
Niangua	Percs slowly, slope.	Low: Low-pressure pipe system or other alternative system, special design to overcome slope, large absorption field, interceptor drains, land shaping.	Surfacing of effluent, contamination of ground water.
Bardley	Thin layer, slope.	Low: Low-pressure pipe system or other alternative system, special design to overcome slope, large absorption field, interceptor drains, land shaping.	Surfacing of effluent, contamination of ground water.
48G: Bardley	Thin layer, slope.	Very low: No known corrective measures.	Surfacing of effluent, contamination of ground water.
Rock outcrop.			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
11D*:				
Bardley	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Gasconade	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
12A Cedargap	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
13A Cedargap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
14B, 14C Peridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
16D Clarksville	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
20C Doniphan	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
22E*:				
Gasconade	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
Rock outcrop.				
26 Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
29 Nolin	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, area reclaim.
30A Kaintuck	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
31A Razort	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
32C------------------- Viraton	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
33F*:				
Knobby---------------	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
Rock outcrop.				
34C, 34D-------------- Gatewood	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
35B------------------- Lebanon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
37B------------------- Hartville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
38*. Riverwash				
40-------------------- Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41B------------------- Plato	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
42C------------------- Gunlock	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
43F------------------- Poynor	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
46F*:				
Clarksville----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Gepp-----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
47F*:				
Niangua--------------	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
47F*:				
Bardley	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
48G*:				
Rock outcrop.				
Bardley	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
11D*:						
Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, thin layer.	Slope, depth to rock, area reclaim.	Slope, droughty, depth to rock.
Gasconade	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
12A. Cedargap	Moderate: seepage.	Slight	Deep to water	Droughty, flooding.	Favorable	D1roughty.
13A. Cedargap	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
14B. Peridge	Moderate: seepage.	Moderate: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
14C. Peridge	Moderate: seepage.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
16D. Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
20C. Doniphan	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Large stones	Large stones, droughty.
22E*:						
Gasconade	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
26. Moniteau	Slight	Severe: wetness.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
29. Nolin	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
30A. Kaintuck	Severe: seepage.	Severe: piping.	Deep to water	Droughty, flooding.	Favorable	Droughty.
31A. Razort	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
32C. Viraton	Moderate: seepage, slope.	Moderate: piping, wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Erodes easily, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
33F*:						
Knobby	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, thin layer.	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.
Rock outcrop.						
34C Gatewood	Moderate: depth to rock, seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, percs slowly.	Depth to rock, area reclaim.	Depth to rock, area reclaim.
34D Gatewood	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, percs slowly.	Depth to rock, slope, area reclaim.	Depth to rock, slope, area reclaim.
35B Lebanon	Moderate: slope.	Severe: hard to pack.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.
37B Hartville	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
38*. Riverwash						
40 Huntington	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
41B Plato	Moderate: seepage.	Severe: thin layer.	Percs slowly	Wetness, droughty.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, droughty.
42C Gunlock	Moderate: slope.	Moderate: piping, wetness.	Slope	Wetness, slope, erodes easily.	Erodes easily, wetness.	Erodes easily.
43F Poynor	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
46F*:						
Clarksville	Severe: seepage, slope.	Moderate: large stones.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Gepp	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope	Slope, droughty.
47F*:						
Niangua	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, depth to rock.	Slope, depth to rock.	Slope, droughty, depth to rock.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
48G*:						
Rock outcrop.						
Bardley----------	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, depth to rock.	Slope, depth to rock.	Slope, droughty, depth to rock.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
11D*:											
Bardley	0-6	Cherty silt loam	GC, CL, SC, CL-ML	A-6, A-4	0-15	60-90	50-75	50-70	45-65	25-35	5-15
	6-30	Silty clay, clay, cherty clay.	GM, SM, MH	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gasconade	0-4	Flaggy silty clay loam.	CL	A-6	10-50	75-90	70-85	60-75	55-65	30-40	15-25
	4-16	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	10-70	45-55	40-50	30-40	20-35	55-65	35-45
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
12A Cedargap	0-18	Cherty silt loam	GM, GC, SC-SM	A-1, A-2-4, A-4	0-10	40-85	30-75	20-60	15-50	20-30	3-10
	18-41	Very cherty silty clay loam, very cherty silt loam.	GC, GM-GC	A-2, A-4, A-1-b A-6	0-10	30-55	25-50	20-45	15-45	25-35	5-12
	41-60	Extremely cherty silty clay, very cherty silty clay, very cherty clay.	GC, GP-GC	A-2-7, A-7-6	5-15	20-50	15-45	15-45	10-40	40-50	15-25
13A Cedargap	0-18	Silt loam	ML	A-4	0-5	90-100	85-95	75-95	70-95	25-35	3-9
	18-28	Very cherty loam, very cherty silt loam, cherty loam.	SM, GM, ML	A-1, A-2, A-4	2-15	40-85	25-75	25-70	20-65	25-35	3-9
	28-60	Extremely cherty silty clay loam, extremely cherty loam, very cherty loam.	GC, GM-GC	A-2-4, A-2-6, A-1-b	5-20	25-50	20-45	15-40	15-35	20-35	5-20
14B, 14C Peridge	0-7	Silt loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-90	<30	4-11
	7-24	Silty clay loam, silt loam.	CL	A-6, A-4, A-7	0	95-100	90-100	85-95	70-95	28-43	9-21
	24-60	Cherty silty clay loam, silty clay loam.	CL	A-6, A-7	0	55-100	50-100	50-95	50-90	39-48	18-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
16D------------- Clarksville	0-16	Very cherty silt loam.	GC, SC, SC-SM, GP-GC	A-2-4, A-2-6, A-1-a	5-30	30-70	10-60	5-50	5-35	20-40	5-15
	16-33	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	33-60	Very cherty silty clay, extremely cherty clay, extremely cherty silty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	20-60	10-50	10-45	55-75	35-55
20C------------- Doniphan	0-13	Very cherty silt loam.	CL-ML, GM, GM-GC, SC-SM	A-4	0-30	50-80	40-70	35-65	35-60	20-30	2-8
	13-18	Cherty silty clay loam, silty clay loam.	CL	A-6	0-30	85-100	60-85	50-80	50-70	30-40	15-25
	18-47	Cherty clay, clay, silty clay.	CH, MH	A-7	0-5	85-100	60-100	55-100	50-90	51-70	25-35
	47-60	Very cherty clay, extremely cherty clay.	GC, GM, GP-GM, GP-GC	A-7, A-2-7	0-20	20-60	10-50	5-50	5-45	51-70	25-35
22E*:											
Gasconade-------	0-3	Cherty silty clay loam.	CL	A-7-6	5-15	75-90	70-85	60-75	55-65	40-45	20-25
	3-18	Very cherty silty clay loam, very cherty silty clay.	GC	A-2-7, A-7-6	15-40	40-60	30-50	30-50	25-40	40-45	20-25
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
26--------------- Moniteau	0-23	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	23-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	85-100	80-95	30-45	15-25
29--------------- Nolin	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	9-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
30A-------------- Kaintuck	0-5	Loam-------------	ML, CL-ML, SM, SC-SM	A-4	0	80-100	75-100	70-90	45-65	<20	NP-5
	5-60	Stratified loamy sand to cherty silt loam.	SC-SM, GM-GC, CL-ML, SM	A-2, A-4	0-10	55-100	50-100	40-90	25-65	<20	NP-5
31A-------------- Razort	0-12	Silt loam--------	ML, CL-ML, CL	A-4	0	80-100	75-100	70-95	50-90	<30	3-10
	12-26	Silt loam, clay loam, gravelly loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	60-100	60-100	55-95	40-85	<40	6-15
	26-60	Gravelly silty clay loam, very gravelly clay loam.	GM, SM, ML, CL-ML	A-2, A-4, A-1	0	30-100	25-100	25-95	20-85	<30	3-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
32C-------------- Viraton	0-5	Silt loam--------	CL, CL-ML	A-4, A-6	0	90-100	75-100	70-95	60-75	20-30	5-11
	5-19	Silt loam, silty clay loam, cherty silty clay loam.	CL, GC, SC	A-4, A-6	0-5	55-100	50-100	50-95	45-75	25-35	8-15
	19-30	Very cherty silt loam, extremely cherty silty clay loam.	GC, CL, SC	A-2, A-4, A-6	0-15	25-70	20-70	20-65	20-55	25-35	8-15
	30-42	Very cherty silty clay, cherty silty clay, cherty clay.	GC, CL, SC	A-2, A-6, A-7	0-10	40-90	35-90	35-85	30-75	30-50	11-25
	42-60	Very cherty clay, clay, extremely cherty silty clay.	GC	A-2, A-6, A-7	0-10	25-50	20-50	20-45	15-40	30-50	11-25
33F*:											
Knobby----------	0-4	Gravelly fine sandy loam.	SC, SC-SM	A-2-4, A-1-b	5-25	65-85	60-85	40-55	20-35	20-30	4-10
	4-9	Very gravelly fine sandy loam, very gravelly loam, very cobbly sandy loam.	GC, SC, GM-GC, SC-SM	A-2-4, A-4, A-1-b	15-40	56-75	45-75	35-65	20-50	20-30	4-10
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
34C-------------- Gatewood	0-10	Cherty silt loam	CL, SC, GC	A-4, A-6, A-2	5-15	70-90	65-85	40-75	30-70	25-35	7-15
	10-38	Cherty silty clay, cherty clay, clay.	CH	A-7	0-10	80-95	60-90	55-90	50-85	55-75	30-45
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
34D-------------- Gatewood	0-6	Cherty silt loam	CL, SC, GC	A-4, A-6, A-2	5-15	70-90	65-85	40-75	30-70	25-35	7-15
	6-24	Cherty silty clay, cherty clay, clay.	CH	A-7	0-10	80-95	60-90	55-90	50-85	55-75	30-45
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
35B-------------- Lebanon	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	85-100	85-100	80-95	60-75	22-35	5-15
	6-13	Silt loam, silty clay loam.	CL	A-6	0-5	85-95	80-95	75-95	60-75	30-40	11-20
	13-23	Silty clay loam, silty clay.	CL	A-7	0-5	85-95	70-95	65-90	55-75	40-50	20-30
	23-37	Cherty silty clay loam, extremely cherty silt loam.	CL, GC	A-2, A-6, A-7	0-10	55-75	30-75	25-70	20-55	35-45	15-20
	37-60	Cherty clay, very cherty clay, silty clay.	CL, CH, SC, GC	A-7, A-2-7	0-10	65-95	30-90	25-90	20-85	45-80	25-45

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
37B-------------- Hartville	0-10	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	95-100	80-95	70-90	30-40	7-15
	10-15	Silt loam, silty clay loam.	CL	A-6, A-7	0-10	95-100	95-100	90-98	85-95	35-45	20-25
	15-60	Silty clay, clay, silty clay loam.	CH	A-7	0-10	95-100	95-100	90-98	85-95	50-60	30-40
38*. Riverwash											
40--------------- Huntington	0-21	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	21-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
41B-------------- Plato	0-6	Silt loam--------	CL-ML, ML	A-4	0-5	100	95-100	90-100	70-90	<25	NP-6
	6-26	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	80-100	75-95	65-85	40-55	20-35
	26-42	Cherty silty clay loam, cherty silt loam.	CL, SC, GC	A-2, A-6, A-7	0-10	55-90	30-85	25-80	20-65	35-45	15-20
	42-60	Very cherty silty clay, cherty clay, cherty silty clay loam.	CL, CH, GC, SC	A-7	0-5	40-75	40-70	35-70	35-65	45-60	30-45
42C-------------- Gunlock	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	100	95-100	90-100	70-90	20-30	5-15
	9-26	Silty clay loam, silty clay.	CL	A-6, A-7	0-5	85-100	85-100	80-100	80-90	35-50	15-30
	26-39	Silty clay loam, cherty silty clay loam, very cherty silt loam.	CL, GC, SC	A-4, A-6, A-7	0-10	40-95	40-90	35-90	35-80	25-45	8-25
	39-60	Silty clay, clay, cherty clay.	CL, CH, GC, SC	A-7	0-10	60-95	50-90	45-90	40-85	45-70	25-40
43F-------------- Poynor	0-7	Very cherty silt loam.	GM, GM-GC, SC-SM, SM	A-1, A-4	5-20	35-70	15-65	10-60	10-45	20-30	2-8
	7-23	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, SC	A-2-6, A-6	5-20	30-70	20-60	20-50	15-45	25-40	10-20
	23-60	Silty clay, clay	CH, MH	A-7	0-10	90-100	90-100	85-95	70-90	51-70	25-35
46F*: Clarksville-----	0-22	Very cherty silt loam.	GC, SC, SC-SM, GP-GC	A-2-4, A-2-6, A-1	0-20	30-70	10-60	5-50	5-35	20-40	5-15
	22-55	Very cherty silty clay loam, very cherty silt loam, extremely cherty silty clay loam.	GC, SC, SP-SC, GP-GC	A-2-6, A-6	5-20	30-70	10-60	10-50	5-45	30-40	15-25
	55-60	Very cherty silty clay, very cherty clay.	GC, SC, GP-GC, SP-SC	A-7, A-2-7	5-20	30-70	10-60	10-50	10-45	55-75	35-55

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
46F*:											
Gepp	0-3	Very cherty silt loam.	CL-ML, CL, GM-GC, GC	A-4	0-25	55-75	50-75	45-75	35-65	<30	4-10
	3-10	Very cherty silt loam, cherty silty clay loam.	GC, GM-GC	A-2, A-4	0-15	30-50	30-50	25-45	25-40	<30	4-10
	10-14	Cherty silt loam, cherty silty clay loam.	CL	A-6, A-4	0-5	65-100	65-100	55-95	51-90	25-40	8-20
	14-60	Cherty clay, clay	MH	A-7	0-5	65-85	65-85	60-80	50-75	60-80	25-40
47F*:											
Niangua	0-3	Very cherty silt loam.	CL-ML, CL, GC, GM-GC	A-4, A-6	0-20	45-80	40-75	35-70	35-60	20-30	5-15
	3-14	Gravelly silt loam, very gravelly silt loam.	CL-ML, CL, GC, GM-GC	A-4, A-6	5-20	45-80	40-75	35-70	35-60	20-30	5-15
	14-25	Silty clay, clay, gravelly silty clay.	CL, CH	A-7	5-15	65-100	60-100	55-90	50-80	45-70	25-45
	25-52	Gravelly clay, clay.	CH	A-7	5-15	65-100	60-100	55-90	50-80	50-70	25-45
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bardley	0-5	Very cherty silt loam.	CL-ML, CL, GC, GM-GC	A-4, A-6	0-20	60-90	50-75	50-70	45-65	25-35	5-15
	5-28	Clay, gravelly clay, silty clay.	GM, SM, MH	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
48G*:											
Rock outcrop.											
Bardley	0-3	Very cherty silt loam.	CL-ML, CL, GC, GM-GC	A-4, A-6	10-30	60-90	50-75	50-70	45-65	25-35	5-15
	3-22	Clay, cherty clay, silty clay.	GM, SM, MH	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
11D*:										
Bardley----------	0-6	18-27	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.28	4	.5-2
	6-30	50-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-7.3	Moderate-----	0.28		
	30	---	---	---	---	---	-------------	----		
Gasconade--------	0-4	35-40	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	2-4
	4-16	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20		
	16	---	---	---	---	---	-------------	----		
12A-------------- Cedargap	0-18	12-25	1.20-1.45	0.6-2.0	0.11-0.18	5.6-7.3	Low----------	0.24	5	1-4
	18-41	20-28	1.30-1.50	0.6-2.0	0.10-0.14	5.6-7.3	Low----------	0.32		
	41-60	40-48	1.20-1.40	0.2-0.6	0.04-0.08	5.6-7.3	Moderate-----	0.20		
13A-------------- Cedargap	0-18	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	1-4
	18-28	12-30	1.30-1.50	0.6-2.0	0.10-0.15	5.6-7.3	Low----------	0.24		
	28-60	18-35	1.40-1.55	0.6-2.0	0.04-0.12	5.6-7.3	Low----------	0.10		
14B, 14C---------- Peridge	0-7	10-20	1.35-1.45	0.6-2.0	0.16-0.20	4.5-6.0	Low----------	0.37	5	1-3
	7-24	18-35	1.30-1.45	0.6-2.0	0.16-0.20	4.5-6.0	Low----------	0.32		
	24-60	30-40	1.30-1.45	0.6-2.0	0.10-0.20	4.5-6.0	Moderate-----	0.28		
16D-------------- Clarksville	0-16	14-20	1.20-1.40	2.0-6.0	0.07-0.12	3.6-6.0	Low----------	0.28	3	.5-2
	16-33	25-35	1.30-1.45	2.0-6.0	0.06-0.10	3.6-5.5	Low----------	0.32		
	33-60	40-75	1.20-1.40	0.6-2.0	0.05-0.08	3.6-5.5	Moderate-----	0.20		
20C-------------- Doniphan	0-13	18-27	1.10-1.30	2.0-6.0	0.08-0.15	4.5-6.5	Low----------	0.28	3	.5-2
	13-18	27-40	1.20-1.40	0.6-2.0	0.10-0.14	3.6-5.5	Moderate-----	0.28		
	18-47	48-70	1.20-1.40	0.6-2.0	0.08-0.10	3.6-5.5	Moderate-----	0.28		
	47-60	48-70	1.20-1.40	0.6-2.0	0.08-0.10	3.6-5.5	Moderate-----	0.28		
22E*:										
Gasconade--------	0-3	35-40	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	2-4
	3-18	35-60	1.35-1.50	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20		
	18	---	---	---	---	---	-------------	----		
Rock outcrop.										
26--------------- Moniteau	0-23	25-35	1.20-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.43	5	1-2
	23-60	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.43		
29--------------- Nolin	0-9	12-35	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low----------	0.43	5	2-4
	9-60	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low----------	0.43		
30A-------------- Kaintuck	0-5	5-18	1.30-1.50	2.0-6.0	0.09-0.15	5.1-7.3	Low----------	0.24	5	.5-2
	5-60	5-18	1.20-1.50	2.0-6.0	0.08-0.20	5.1-7.3	Low----------	0.32		
31A-------------- Razort	0-12	10-25	1.35-1.60	0.6-2.0	0.10-0.22	5.6-7.3	Low----------	0.37	5	1-3
	12-26	18-35	1.35-1.60	0.6-2.0	0.13-0.22	5.1-7.3	Low----------	0.32		
	26-60	27-35	1.35-1.50	0.6-2.0	0.08-0.12	5.6-7.3	Low----------	0.32		
32C-------------- Viraton	0-5	15-25	1.30-1.50	0.6-2.0	0.18-0.22	4.5-7.3	Low----------	0.43	4	.5-2
	5-19	18-35	1.30-1.50	0.6-2.0	0.08-0.16	4.5-6.0	Low----------	0.43		
	19-30	18-30	1.60-1.90	<0.06	0.01-0.05	3.6-5.5	Low----------	0.32		
	30-42	30-60	1.10-1.40	0.2-0.6	0.02-0.06	4.5-7.3	Moderate-----	0.28		
	42-60	30-60	1.10-1.40	0.2-0.6	0.06-0.10	4.5-7.3	Moderate-----	0.24		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
33F*:										
Knobby----------	0-4	10-18	1.30-1.50	0.6-2.0	0.08-0.12	6.6-7.8	Low----------	0.17	1	1-2
	4-9	10-18	1.30-1.50	0.6-2.0	0.07-0.11	6.6-7.8	Low----------	0.17		
	9	---	---	---	---	---	-------------	----		
Rock outcrop.										
34C-------------- Gatewood	0-10	15-25	1.10-1.40	0.6-2.0	0.12-0.17	5.1-7.3	Low----------	0.32	3	.5-2
	10-38	60-85	1.10-1.30	0.06-0.2	0.09-0.12	5.1-7.8	High---------	0.32		
	38	---	---	---	---	---	-------------	----		
34D-------------- Gatewood	0-6	15-25	1.10-1.40	0.6-2.0	0.12-0.17	5.1-7.3	Low----------	0.32	3	.5-2
	6-24	60-85	1.10-1.30	0.06-0.2	0.09-0.12	5.1-7.8	High---------	0.32		
	24	---	---	---	---	---	-------------	----		
35B-------------- Lebanon	0-6	10-20	1.20-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.43	4	.5-2
	6-13	20-30	1.30-1.50	0.6-2.0	0.14-0.20	4.5-6.5	Low----------	0.43		
	13-23	35-45	1.30-1.50	0.2-0.6	0.13-0.20	4.5-5.5	Moderate-----	0.32		
	23-37	25-40	1.60-1.90	<0.06	0.06-0.10	4.5-5.5	Low----------	0.32		
	37-60	40-80	1.40-1.60	0.06-0.2	0.02-0.06	4.5-5.5	Moderate-----	0.32		
37B-------------- Hartville	0-10	20-27	1.10-1.30	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	1-3
	10-15	24-40	1.20-1.40	0.06-0.2	0.18-0.21	4.5-6.0	Moderate-----	0.43		
	15-60	35-60	1.20-1.50	0.06-0.2	0.10-0.12	4.5-6.5	High---------	0.32		
38*. Riverwash										
40--------------- Huntington	0-21	18-30	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low----------	0.28	5	3-6
	21-60	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low----------	0.32		
41B-------------- Plato	0-6	12-20	1.20-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43	4	1-2
	6-26	27-45	1.30-1.50	0.2-0.6	0.10-0.18	3.6-5.5	Moderate-----	0.32		
	26-42	25-40	1.60-1.90	<0.06	0.01-0.05	4.5-5.5	Low----------	0.32		
	42-60	35-45	1.40-1.60	0.6-2.0	0.02-0.06	4.5-6.0	Moderate-----	0.24		
42C-------------- Gunlock	0-9	15-25	1.20-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	4	1-2
	9-26	35-45	1.30-1.50	0.2-0.6	0.12-0.18	4.5-6.5	Moderate-----	0.37		
	26-39	20-35	1.50-1.70	0.2-0.6	0.08-0.14	4.5-6.5	Low----------	0.37		
	39-60	35-65	1.30-1.50	0.2-0.6	0.06-0.18	4.5-6.5	Moderate-----	0.37		
43F-------------- Poynor	0-7	10-22	1.20-1.45	2.0-6.0	0.04-0.12	3.6-6.5	Low----------	0.28	3	.5-1
	7-23	27-35	1.40-1.55	0.6-2.0	0.02-0.09	3.6-6.0	Low----------	0.28		
	23-60	42-70	1.50-1.65	0.6-2.0	0.08-0.12	3.6-5.0	Moderate-----	0.28		
46F*:										
Clarksville-----	0-22	15-27	1.20-1.40	2.0-6.0	0.07-0.12	3.6-6.0	Low----------	0.28	3	.5-2
	22-55	25-35	1.30-1.45	2.0-6.0	0.06-0.10	3.6-5.5	Low----------	0.32		
	55-60	40-75	1.20-1.40	0.6-2.0	0.05-0.08	3.6-5.5	High---------	0.20		
Gepp------------	0-3	10-25	1.25-1.45	0.6-2.0	0.12-0.17	5.1-6.5	Low----------	0.28	5	.5-2
	3-10	10-25	1.25-1.45	0.6-2.0	0.06-0.12	5.1-6.5	Low----------	0.32		
	10-14	60-80	1.20-1.40	0.6-2.0	0.10-0.16	4.5-6.0	Low----------	0.28		
	14-60	55-80	1.15-1.35	0.6-2.0	0.07-0.11	4.5-6.5	Moderate-----	0.28		
47F*:										
Niangua---------	0-3	18-27	1.10-1.40	0.6-2.0	0.10-0.17	5.6-7.3	Low----------	0.24	3	.5-2
	3-14	18-27	1.10-1.40	0.6-2.0	0.09-0.14	5.1-6.0	Low----------	0.24		
	14-25	50-85	1.10-1.30	0.2-0.6	0.08-0.12	4.5-6.0	Moderate-----	0.32		
	25-52	60-85	1.10-1.30	0.2-0.6	0.07-0.10	5.1-7.8	Moderate-----	0.32		
	52	---	---	---	---	---	-------------	----		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
47F*:										
Bardley---------	0-5	18-27	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.28	4	.5-2
	5-28	50-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-7.3	Moderate-----	0.28		
	28	---	---	---	---	---	-------------	----		
48G*:										
Rock outcrop.										
Bardley---------	0-3	18-27	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.28	4	.5-2
	3-22	50-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-7.3	Moderate-----	0.28		
	22	---	---	---	---	---	-------------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
11D*:												
Bardley	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Gasconade	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
12A Cedargap	B	Frequent	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low	Low.
13A Cedargap	B	Frequent	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low	Low.
14B, 14C Peridge	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
16D Clarksville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
20C Doniphan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
22E*:												
Gasconade	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
Rock outcrop.												
26 Moniteau	C/D	Rare	---	---	0-1.0	Apparent	Nov-May	>60	---	High	High	High.
29 Nolin	B	Occasional	Brief to long.	Nov-Jun	>6.0	---	---	>60	---	---	Low	Moderate.
30A Kaintuck	B	Frequent	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	High	Moderate.
31A Razort	B	Rare	---	---	>6.0	---	---	>60	---	---	Low	Low.
32C Viraton	C	None	---	---	1.5-2.5	Perched	Nov-May	>60	---	Moderate	Moderate	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
33F*:												
Knobby-----------	D	None--------	---	---	>6.0	---	---	<10	Hard	Low------	Low------	Low.
Rock outcrop.												
34C, 34D---------- Gatewood	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Moderate.
35B--------------- Lebanon	C	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	Moderate	Moderate	High.
37B--------------- Hartville	C	None--------	---	---	1.5-3.0	Perched	Nov-May	>60	---	High-----	Moderate	Moderate.
38*. Riverwash												
40---------------- Huntington	B	Frequent----	Brief-----	Nov-Jun	>6.0	---	---	>60	---	High-----	Low------	Moderate.
41B--------------- Plato	C	None--------	---	---	1.0-2.5	Perched	Nov-May	>60	---	Moderate	High-----	High.
42C--------------- Gunlock	C	None--------	---	---	2.0-3.0	Perched	Nov-May	>60	---	Moderate	Moderate	High.
43F--------------- Poynor	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
46F*:												
Clarksville------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	High.
Gepp-------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
47F*:												
Niangua----------	C	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	High-----	Moderate.
Bardley----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
48G*:												
Rock outcrop.												
Bardley----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bardley	Very fine, mixed, mesic Typic Hapludalfs
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Clarksville	Loamy-skeletal, siliceous, mesic Typic Paleudults
Doniphan	Clayey, mixed, mesic Typic Paleudults
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Gatewood	Very fine, mixed, mesic Typic Hapludalfs
Gepp	Very fine, mixed, mesic Typic Paleudalfs
Gunlock	Fine, mixed, mesic Typic Hapludalfs
Hartville	Fine, mixed, mesic Aquic Hapludalfs
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Kaintuck	Coarse-loamy, siliceous, nonacid, mesic Typic Udifluvents
Knobby	Loamy-skeletal, mixed, mesic Lithic Hapludolls
Lebanon	Fine, mixed, mesic Typic Fragiudalfs
Moniteau	Fine-silty, mixed, mesic Typic Ochraqualfs
Niangua	Very fine, mixed, mesic Typic Hapludalfs
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Peridge	Fine-silty, mixed, mesic Typic Paleudalfs
Plato	Fine, mixed, mesic Aquic Fragiudalfs
Poynor	Loamy-skeletal over clayey, siliceous, mesic Typic Paleudults
Razort	Fine-loamy, mixed, mesic Mollic Hapludalfs
Viraton	Fine-loamy, siliceous, mesic Typic Fragiudalfs

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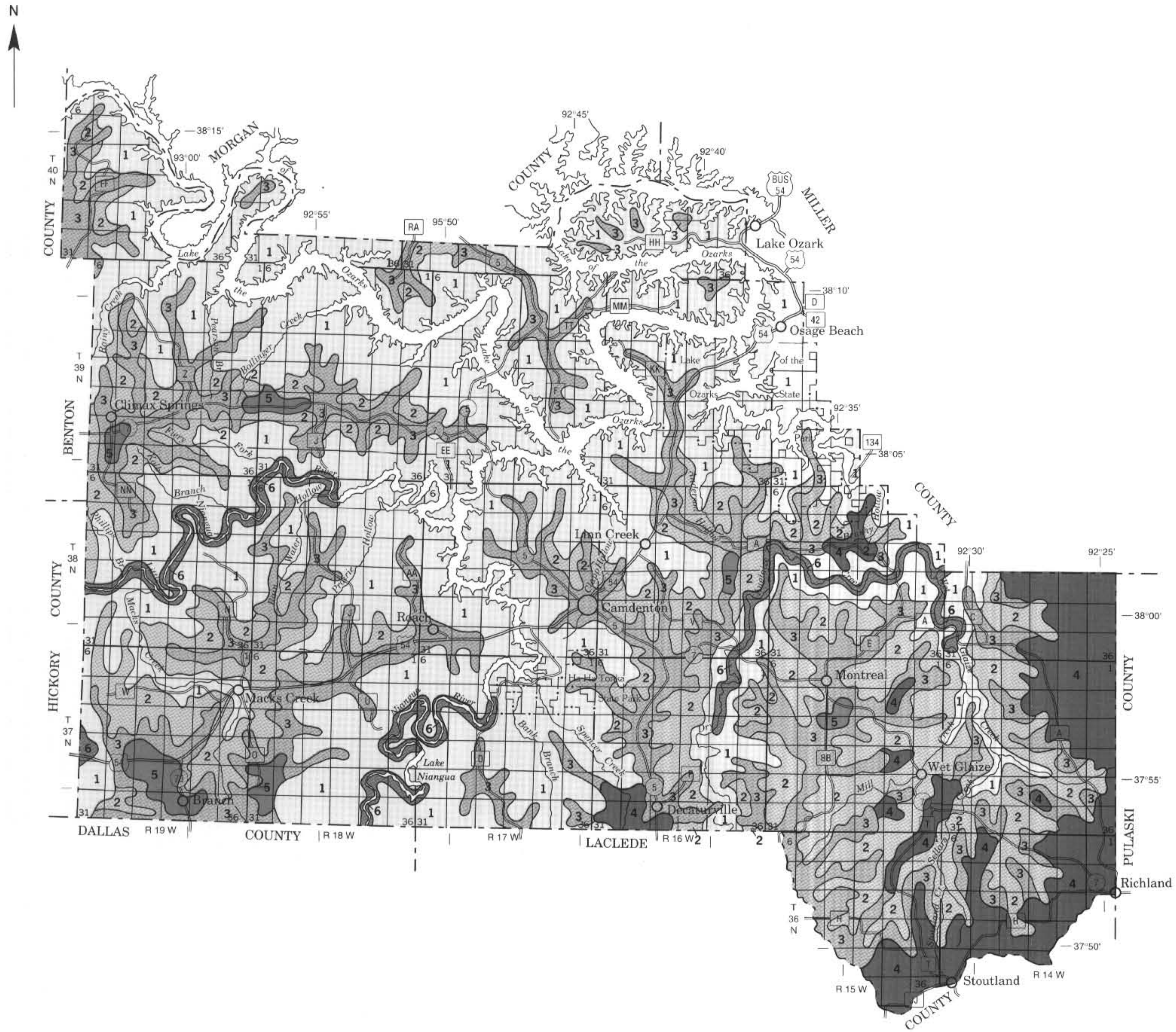

SOIL LEGEND

1	Niangua-Bardley association
2	Clarksville-Doniphan-Gepp association
3	Doniphan-Lebanon-Viraton association
4	Gatewood-Doniphan-Gunlock association
5	Lebanon-Plato association
6	Nolin-Peridge-Huntington association

*The units on this legend are described in the text under the heading " General Soil Map Units."

Compiled 1992

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MISSOURI AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

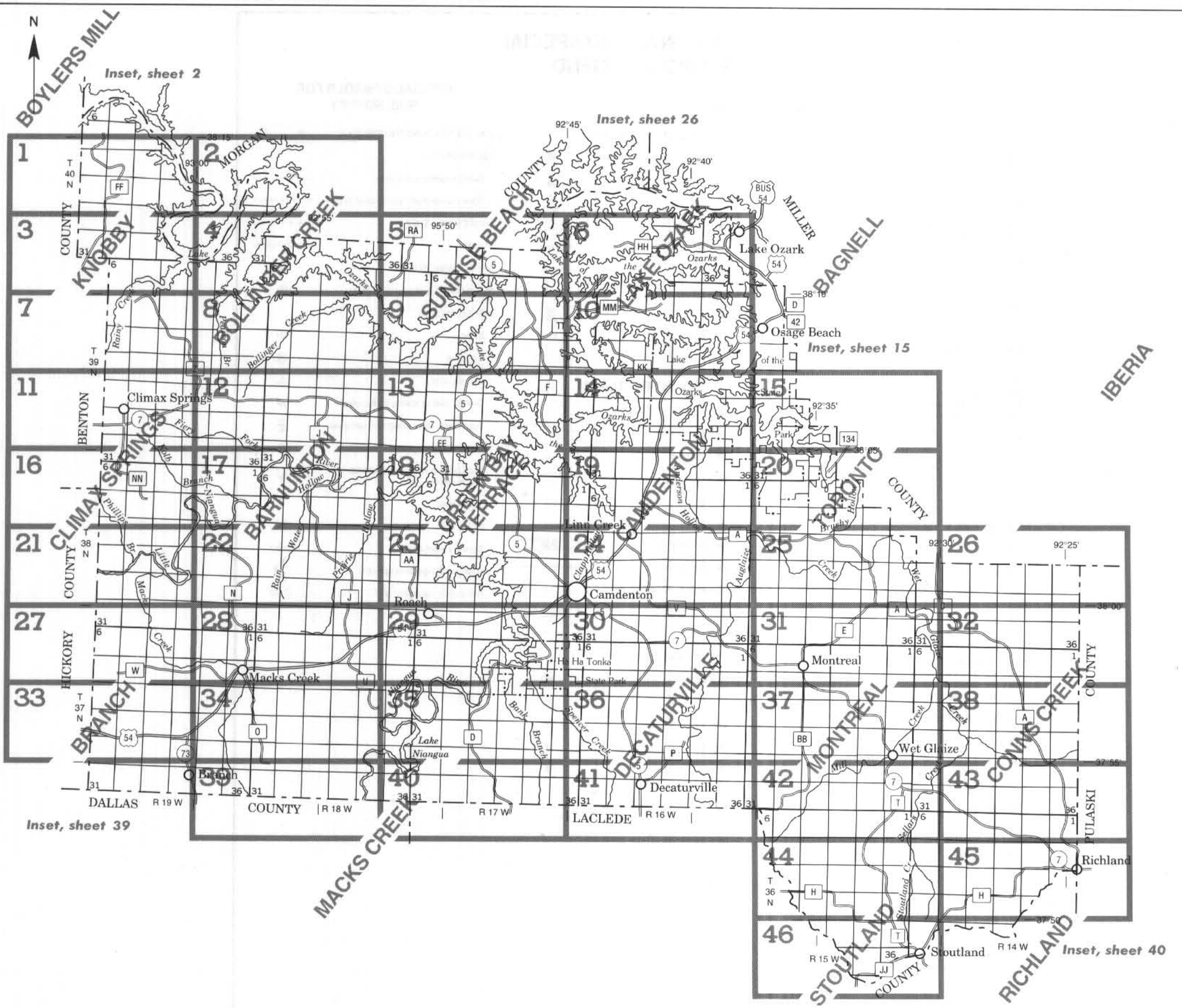
CAMDEN COUNTY, MISSOURI

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



General Soil Map

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INDEX TO MAP SHEETS

CAMDEN COUNTY, MISSOURI

Scale 1:253,440

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
11D	Bardley-Gasconade complex, 5 to 14 percent slopes
12A	Cedargap cherty silt loam, clayey substratum, 0 to 3 percent slopes
13A	Cedargap silt loam, 0 to 3 percent slopes
14B	Peridge silt loam, 2 to 5 percent slopes
14C	Peridge silt loam, 5 to 9 percent slopes
16D	Clarksville very cherty silt loam, 9 to 14 percent slopes
20C	Doniphan very cherty silt loam, 3 to 9 percent slopes
22E	Gasconade-Rock outcrop complex, 5 to 20 percent slopes
26	Moniteau silt loam
29	Nolin silt loam
30A	Kaintuck loam, 0 to 3 percent slopes
31A	Razort silt loam, 0 to 3 percent slopes
32C	Viraton silt loam, 3 to 9 percent slopes
33F	Knobby-Rock outcrop complex, 20 to 50 percent slopes
34C	Gatewood cherty silt loam, 5 to 9 percent slopes
34D	Gatewood cherty silt loam, 9 to 14 percent slopes
35B	Lebanon silt loam, 2 to 5 percent slopes
37B	Hartville silt loam, 2 to 5 percent slopes
38	Riverwash
40	Huntington silt loam
41B	Plato silt loam, 1 to 4 percent slopes
42C	Gunlock silt loam, 3 to 9 percent slopes
43F	Poynor very cherty silt loam, 14 to 35 percent slopes
46F	Clarksville-Gepp very cherty silt loams, 14 to 35 percent slopes, stony
47F	Niangua-Bardley very cherty silt loams, 14 to 50 percent slopes, very stony
48G	Rock outcrop-Bardley complex, 35 to 99 percent slopes

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CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS — 29 26
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE (normally not shown)
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot

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1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

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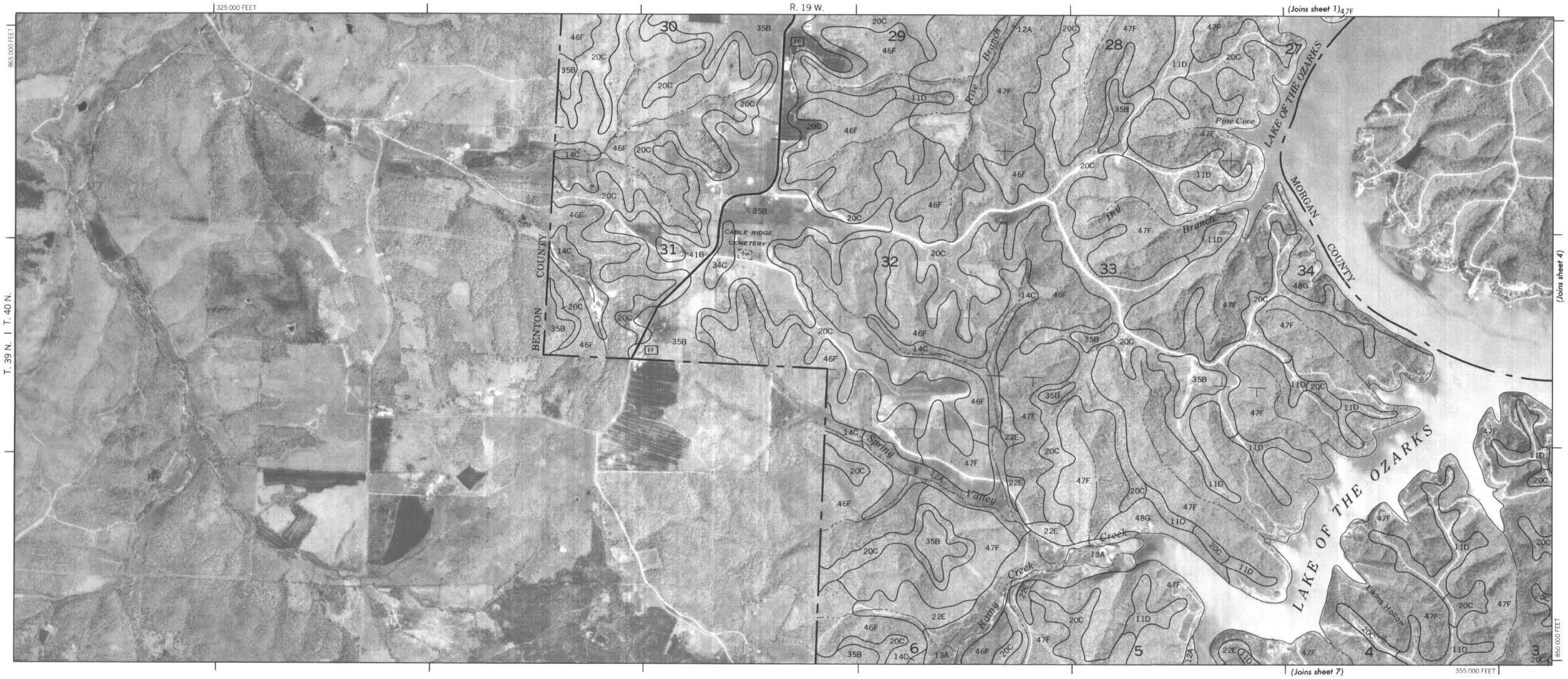

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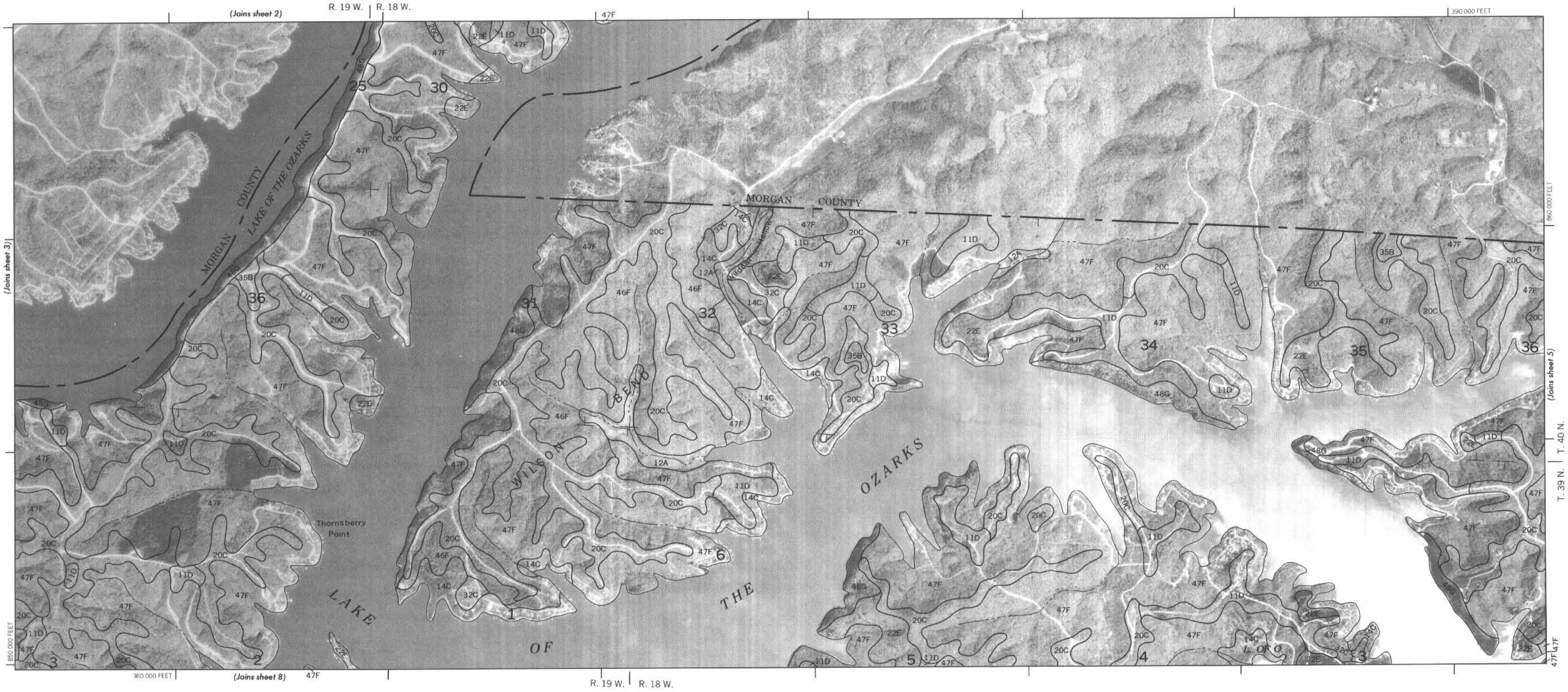

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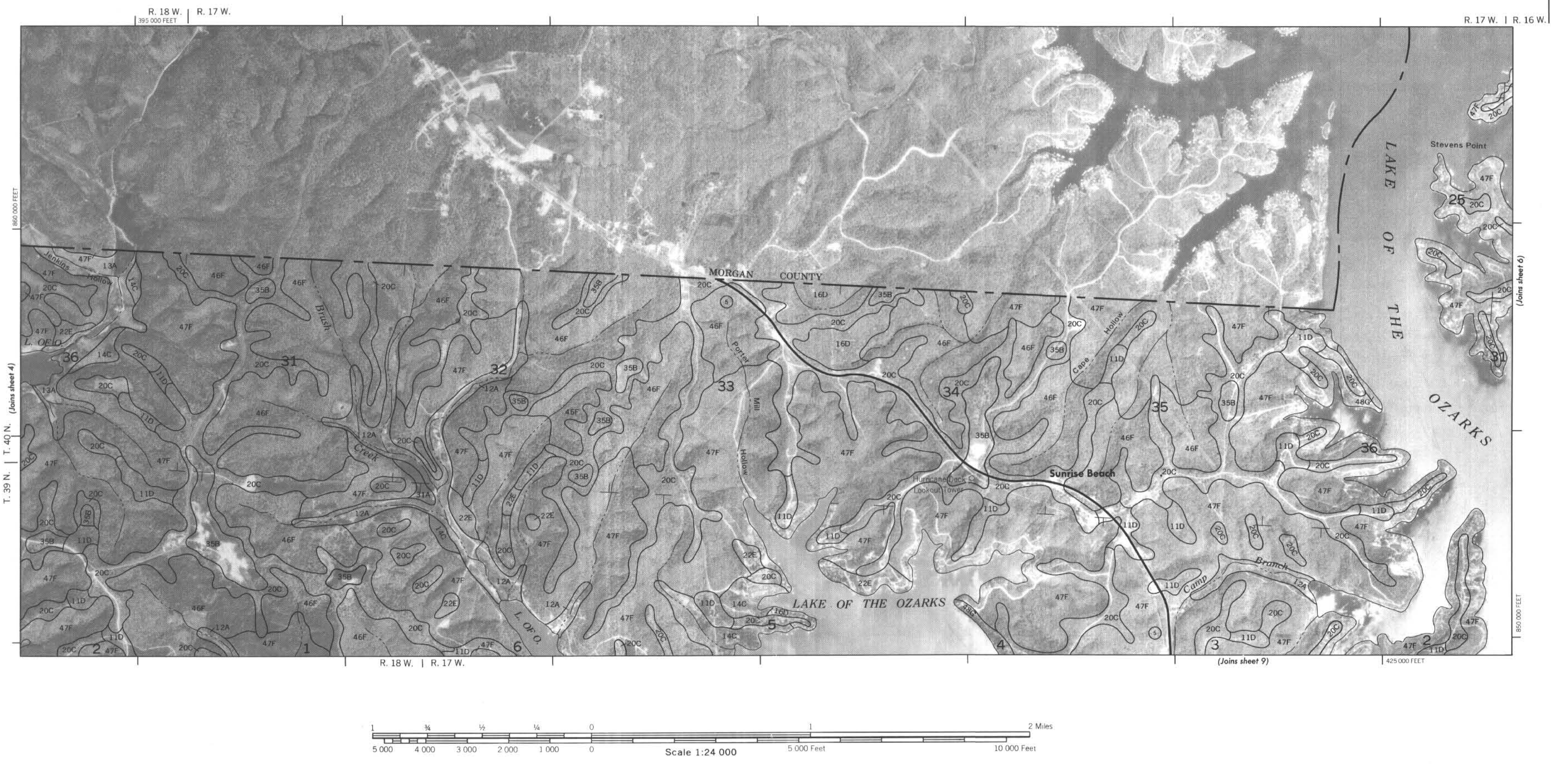

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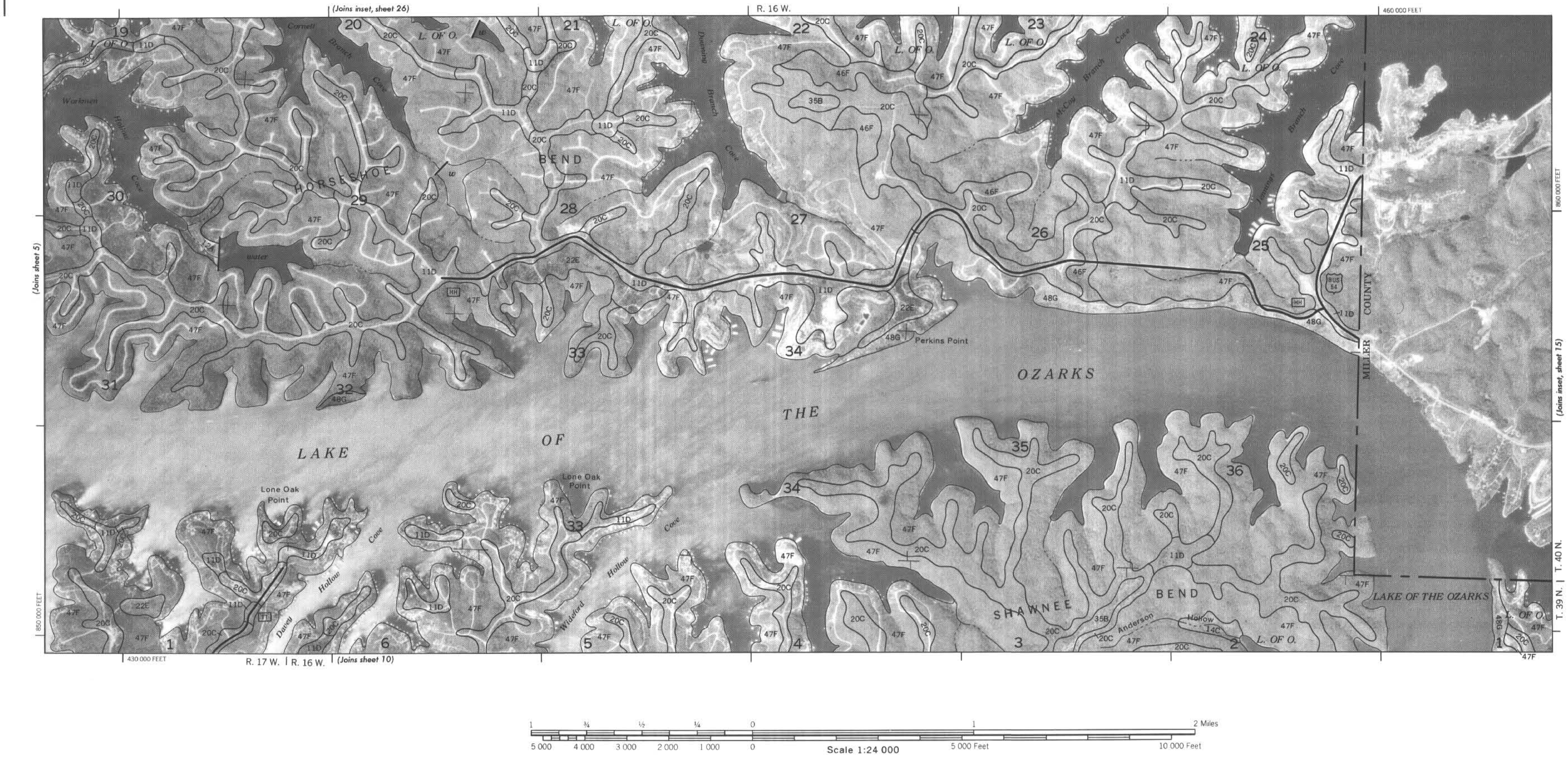

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Scale 1:24 000

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1 ¾ ½ ¼ 0 1 2 Miles

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Scale 1:24 000

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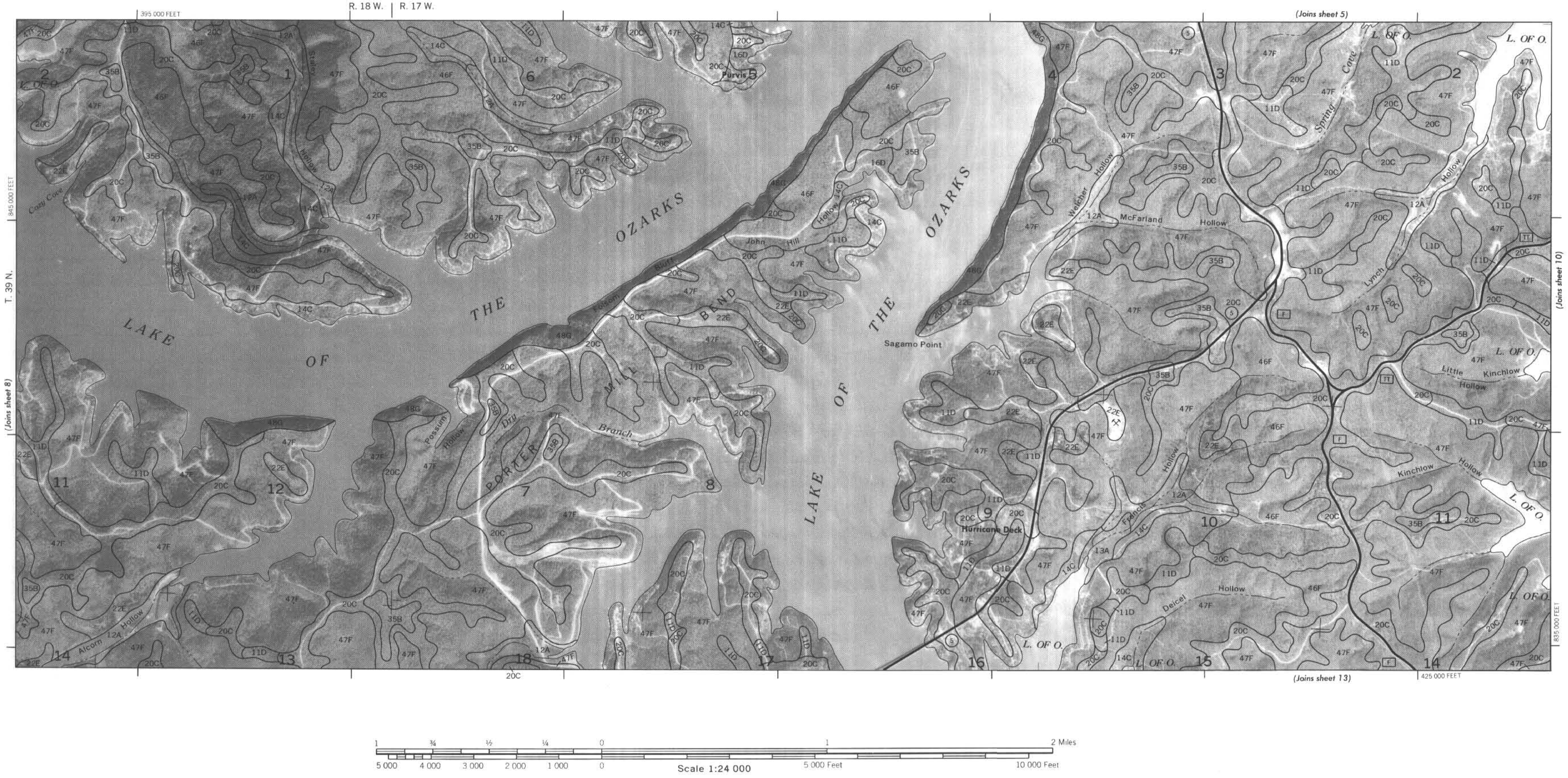

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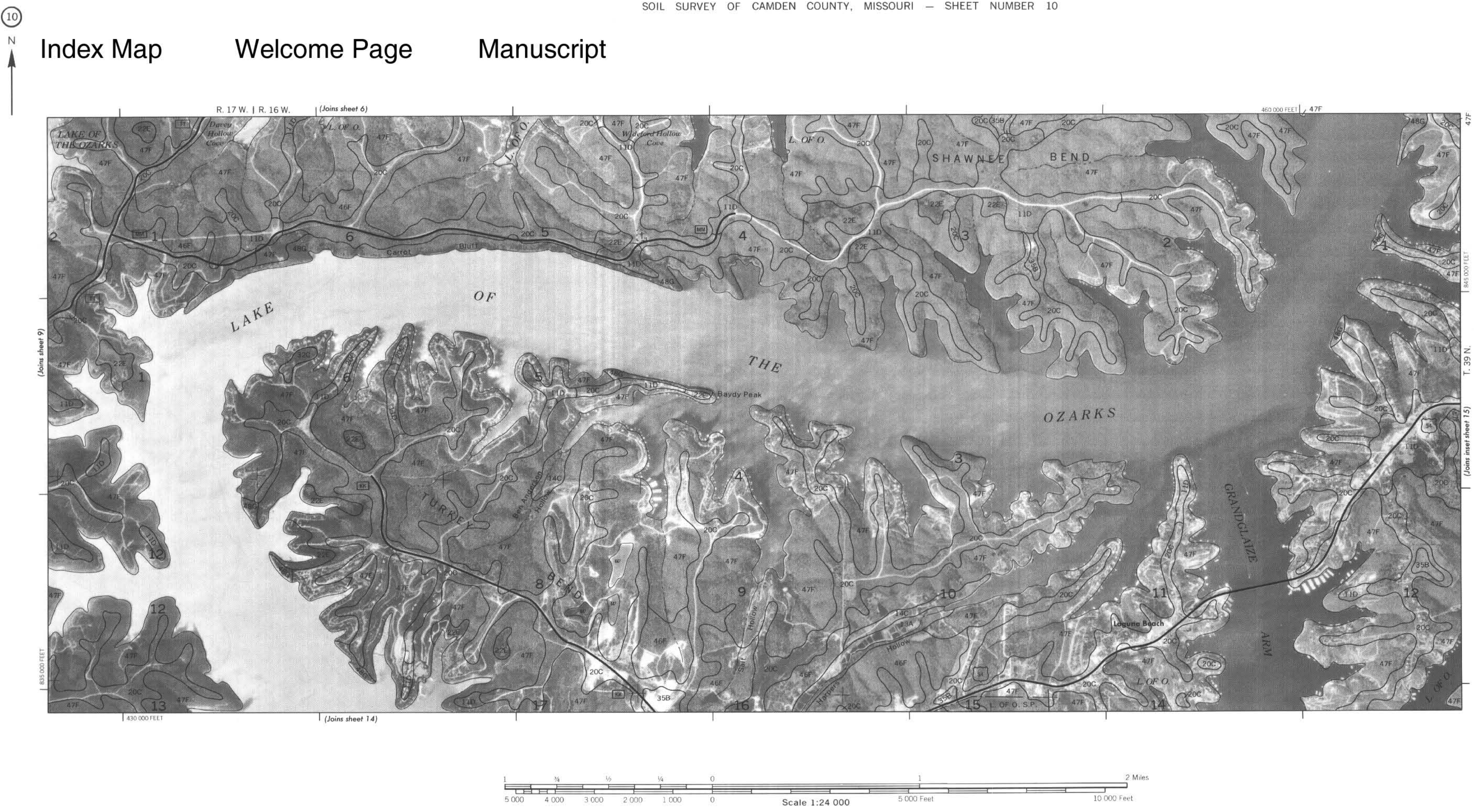

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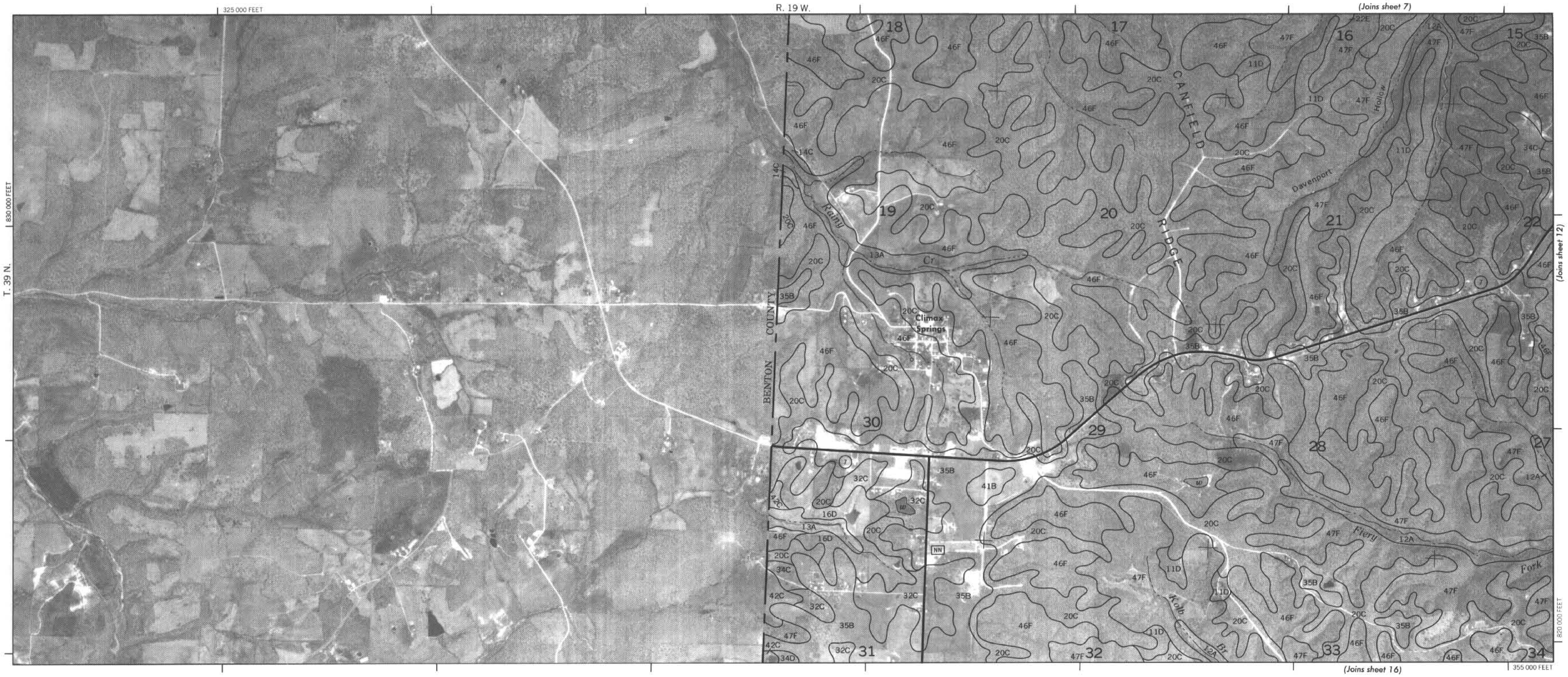

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Scale 1:24 000

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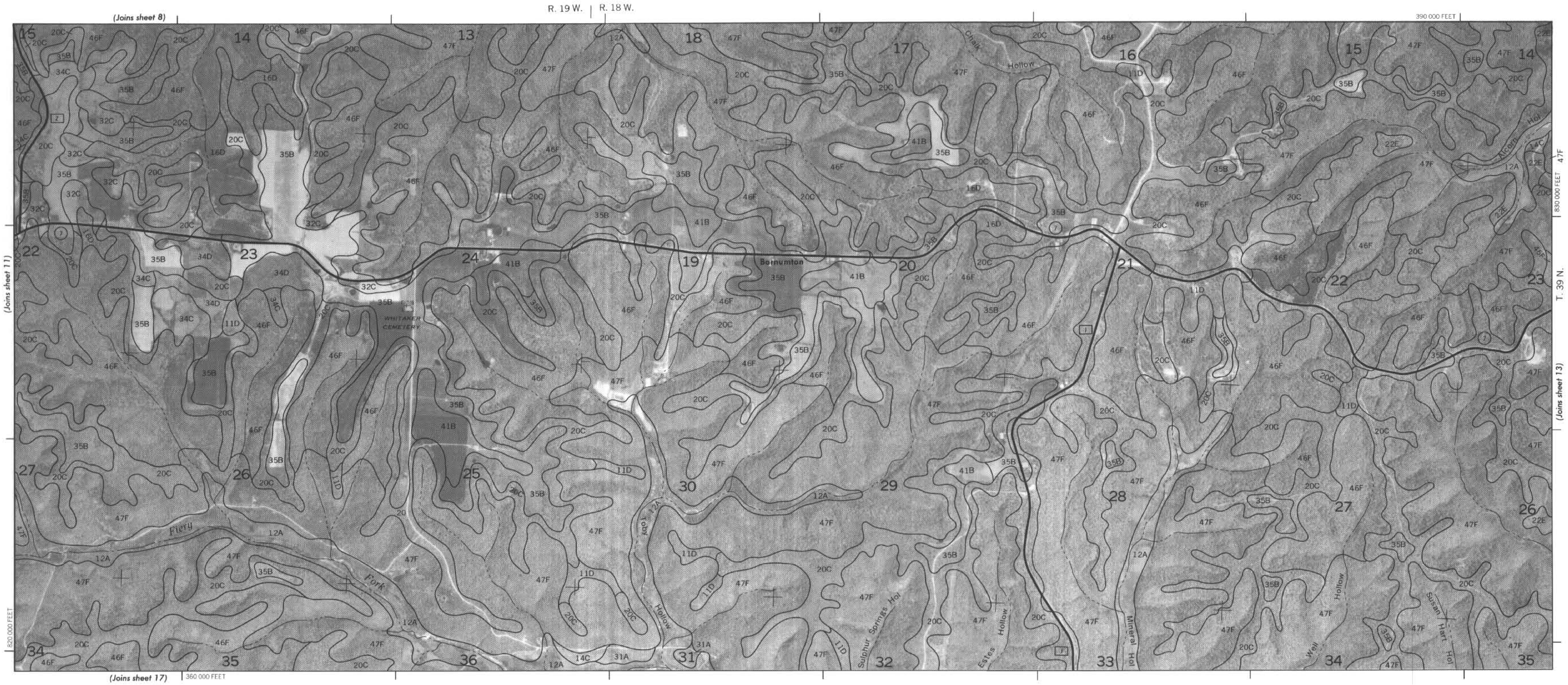

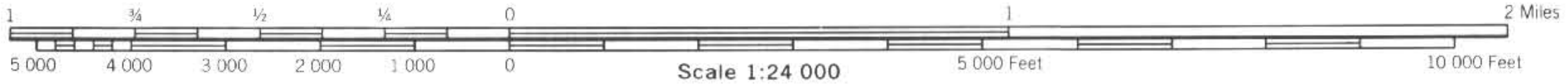

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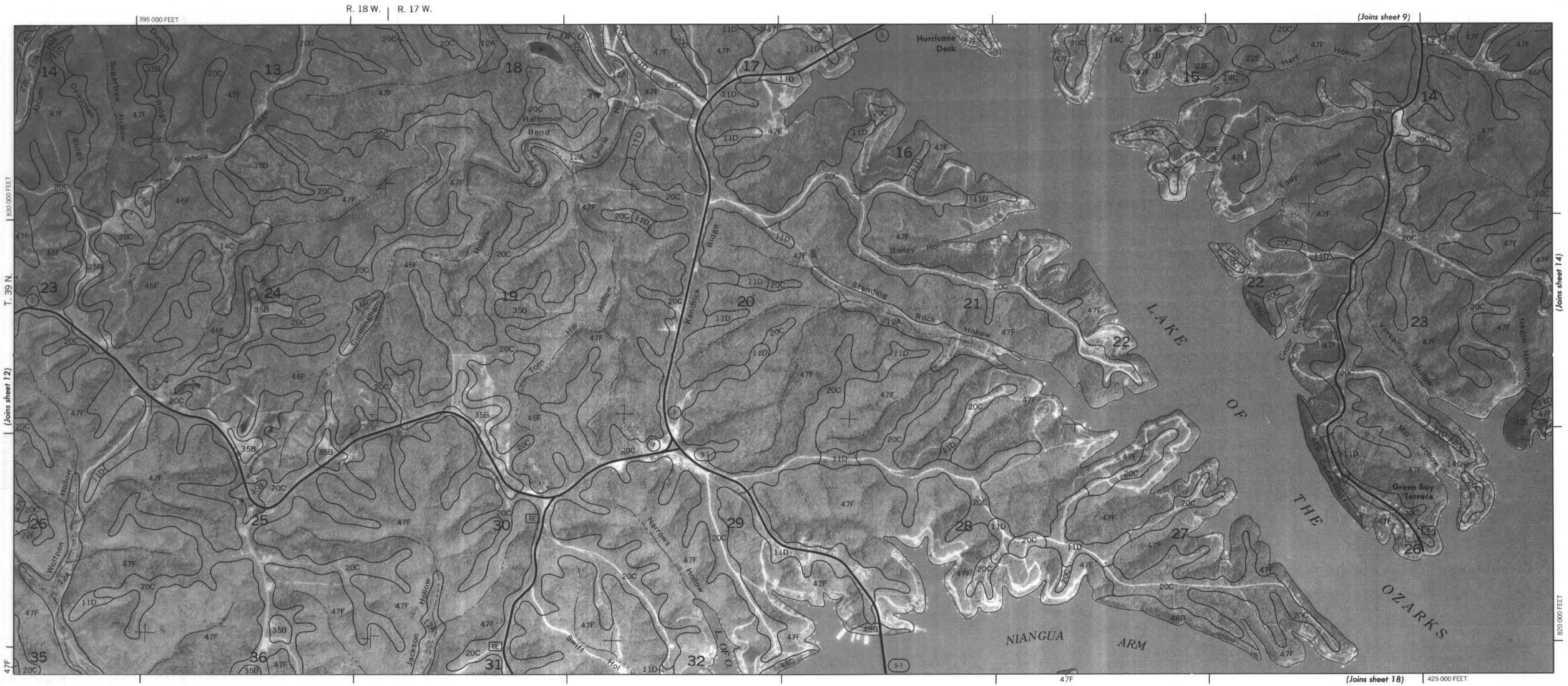

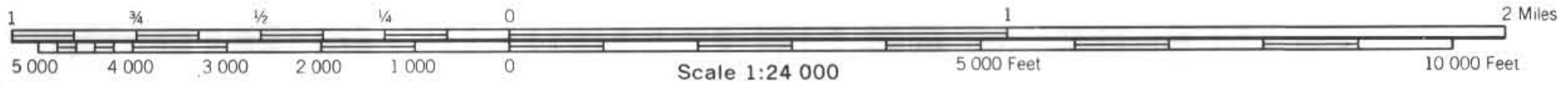

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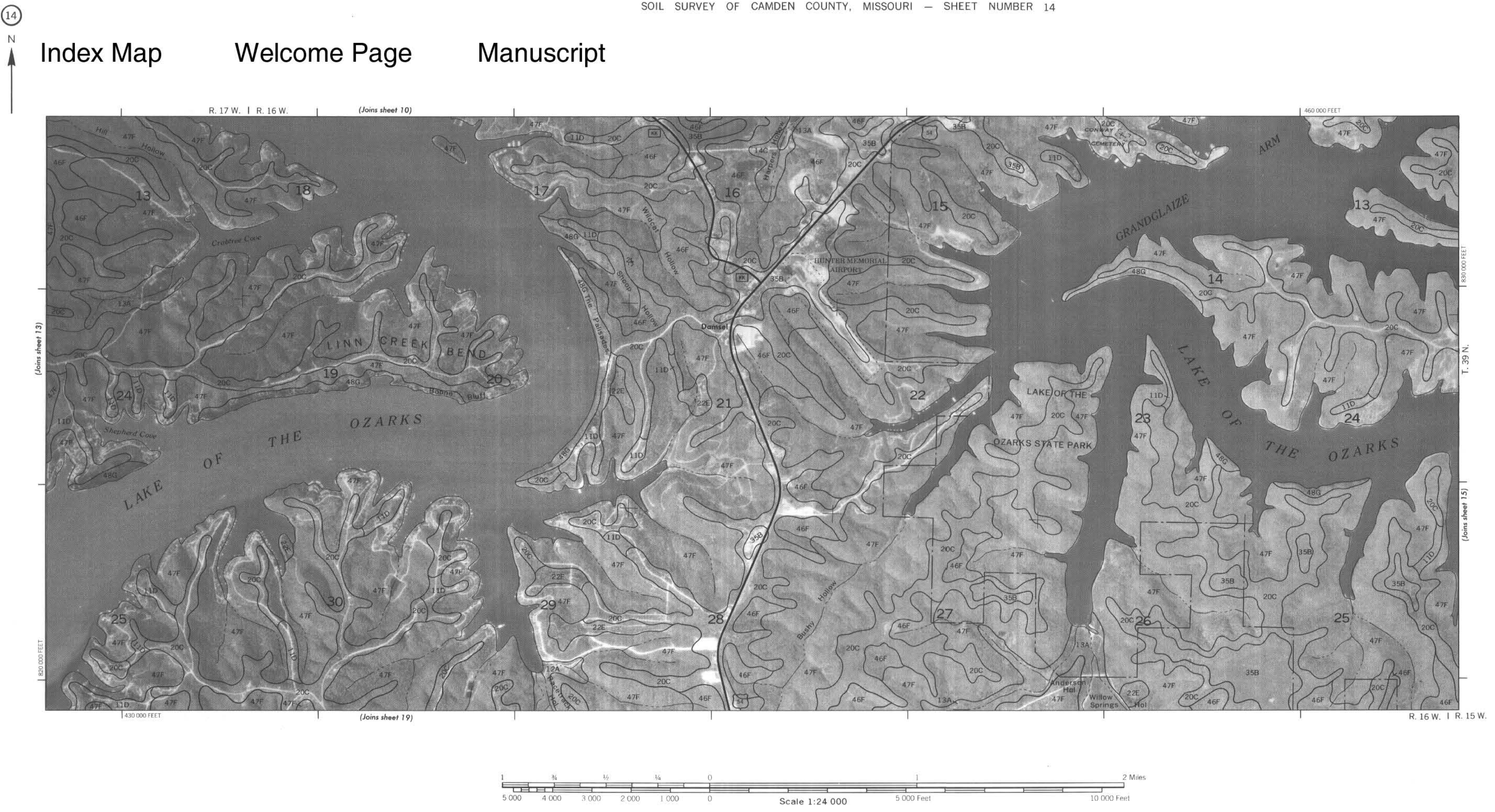

SOIL SURVEY OF CAMDEN COUNTY, MISSOURI — SHEET NUMBER 15

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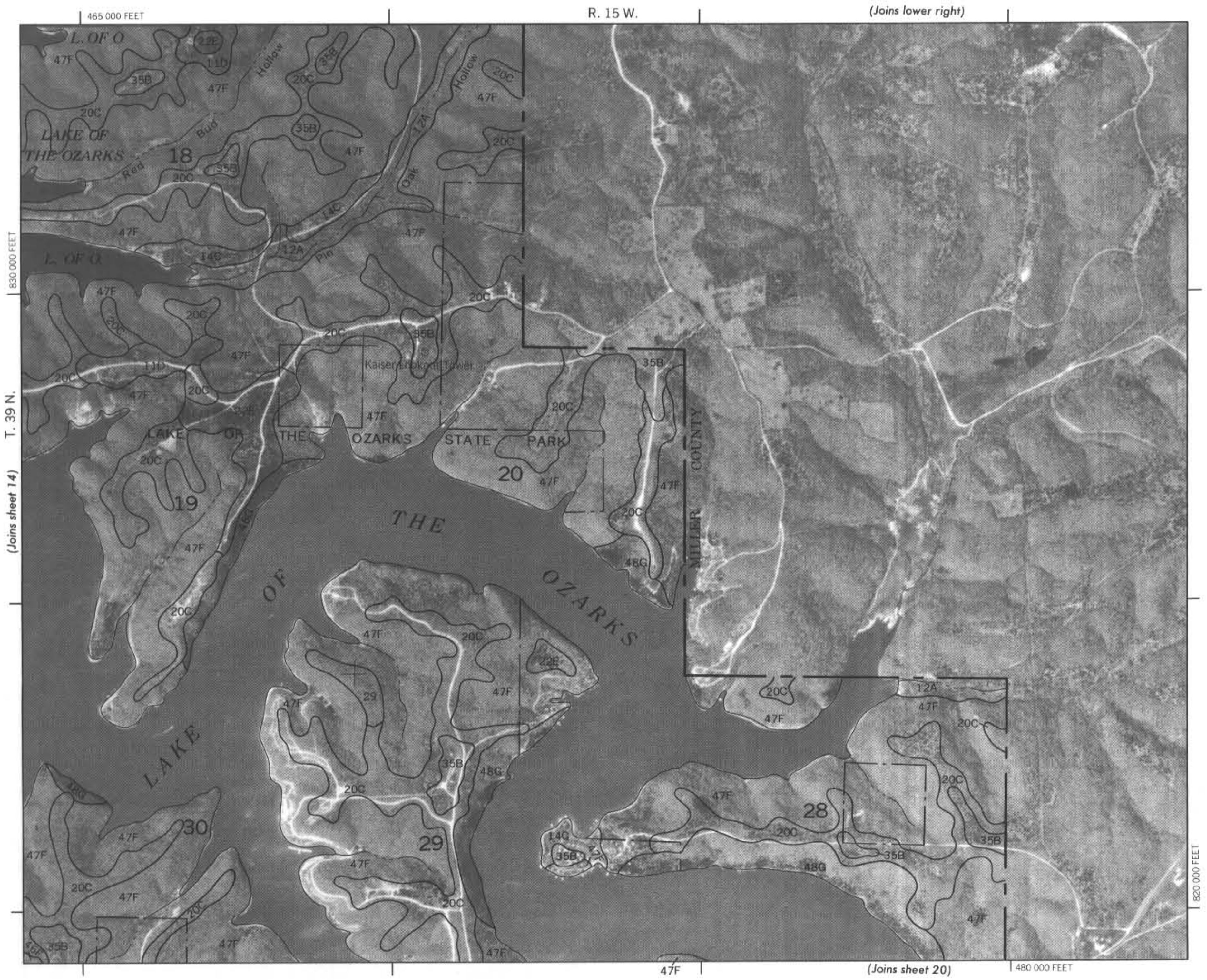

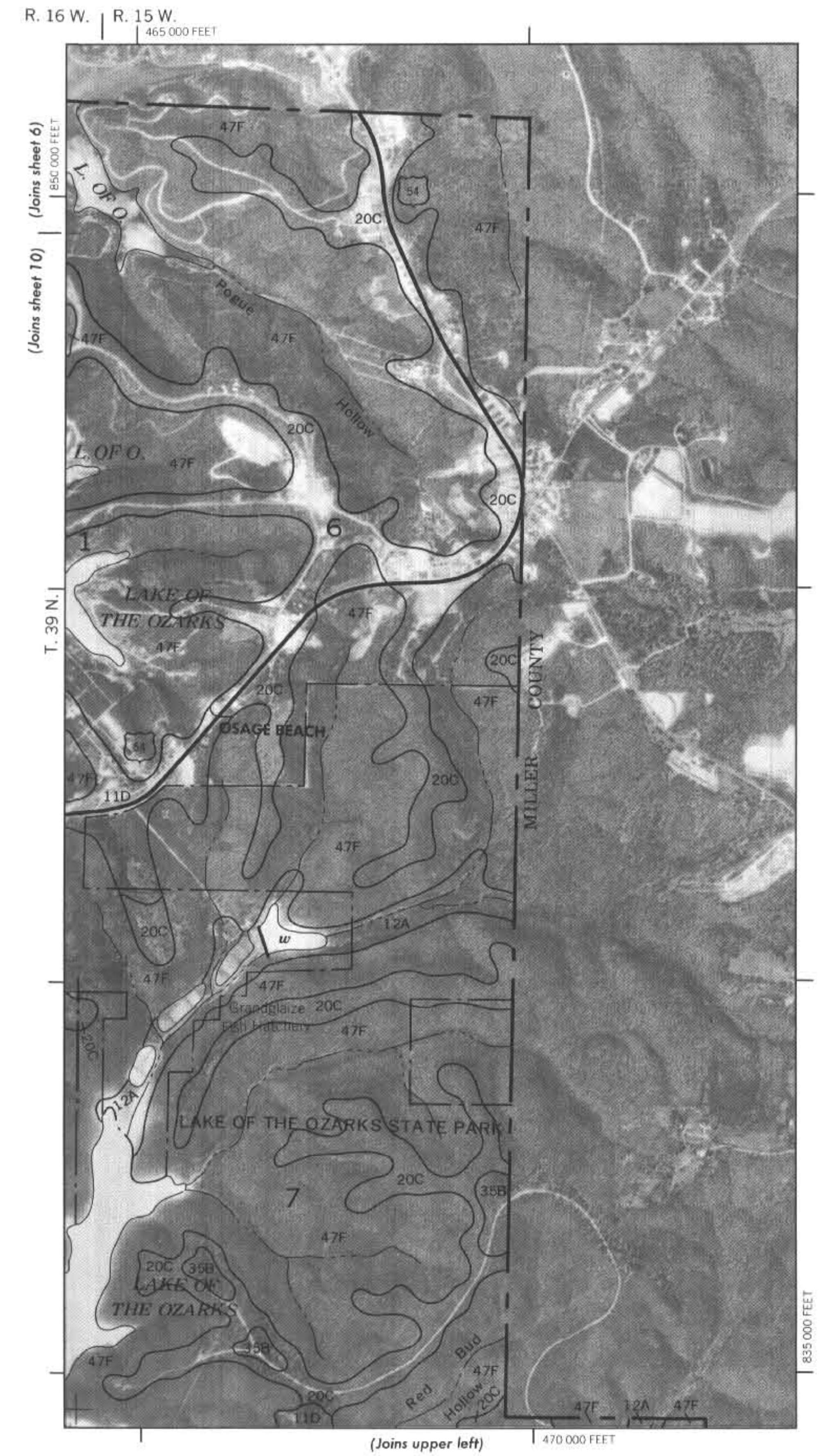

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Scale 1:24 000

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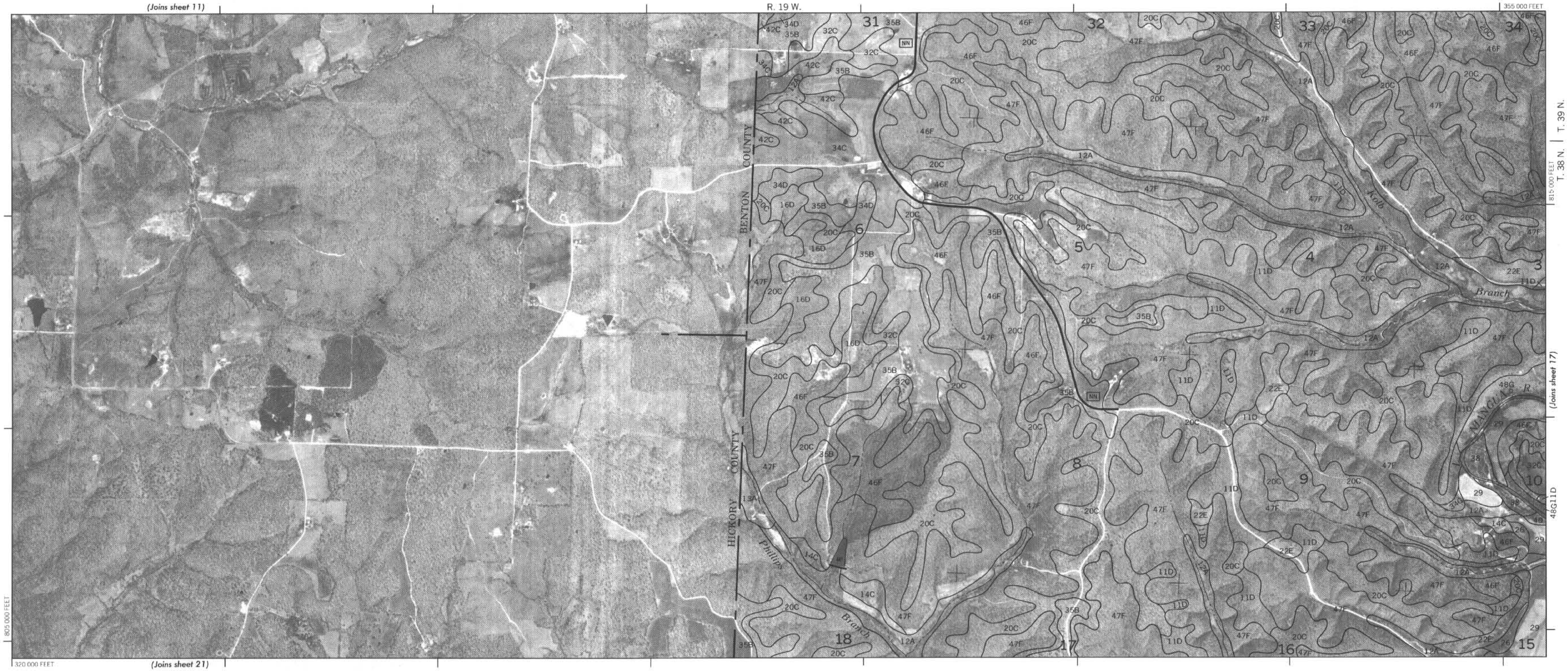

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Scale 1:24 000

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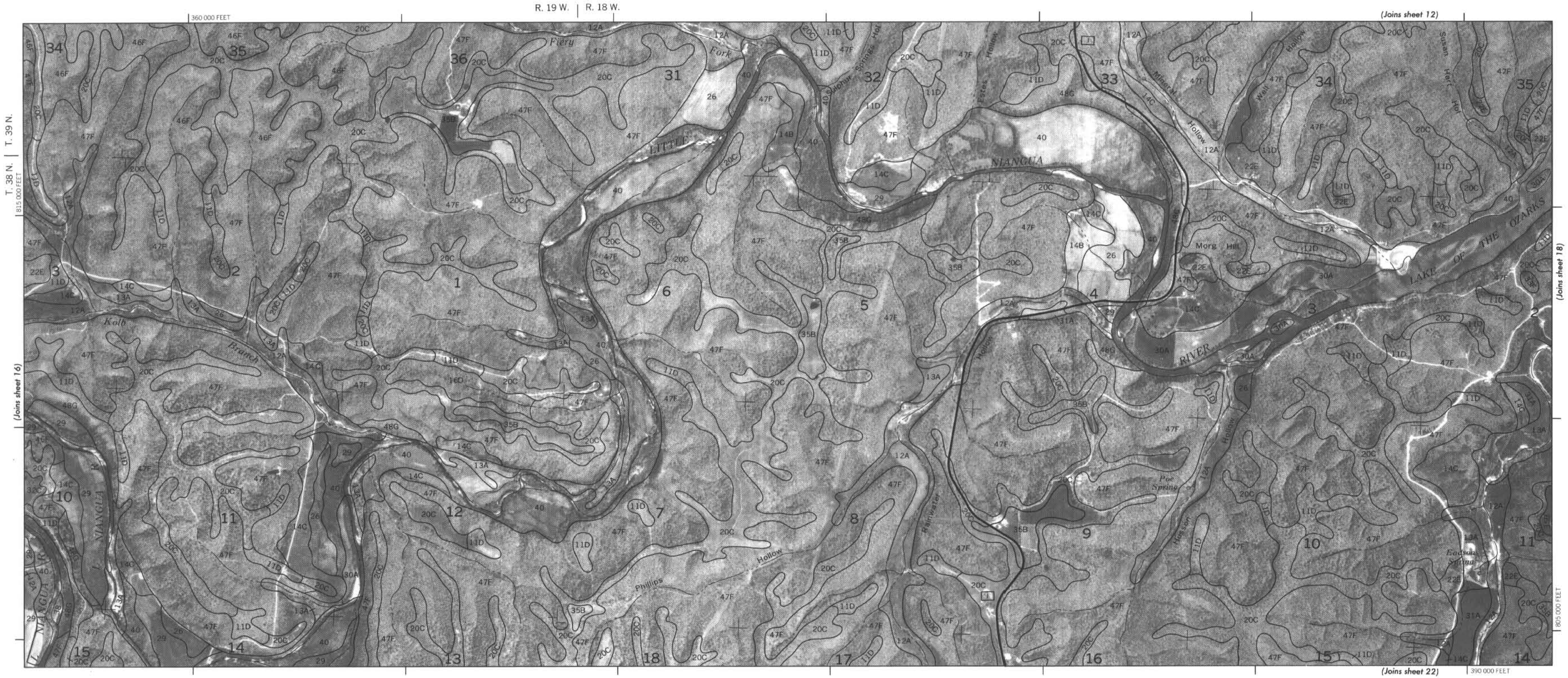

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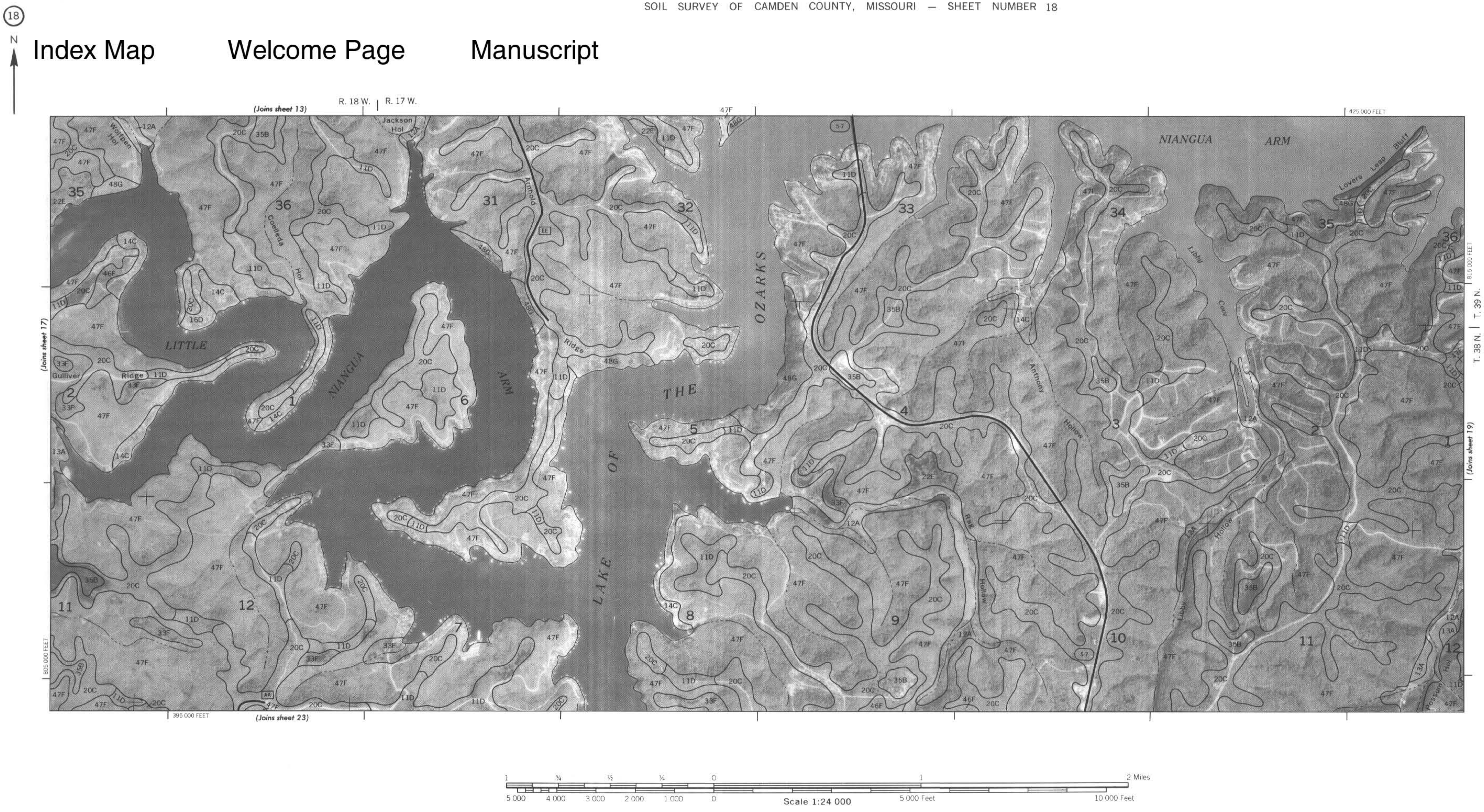

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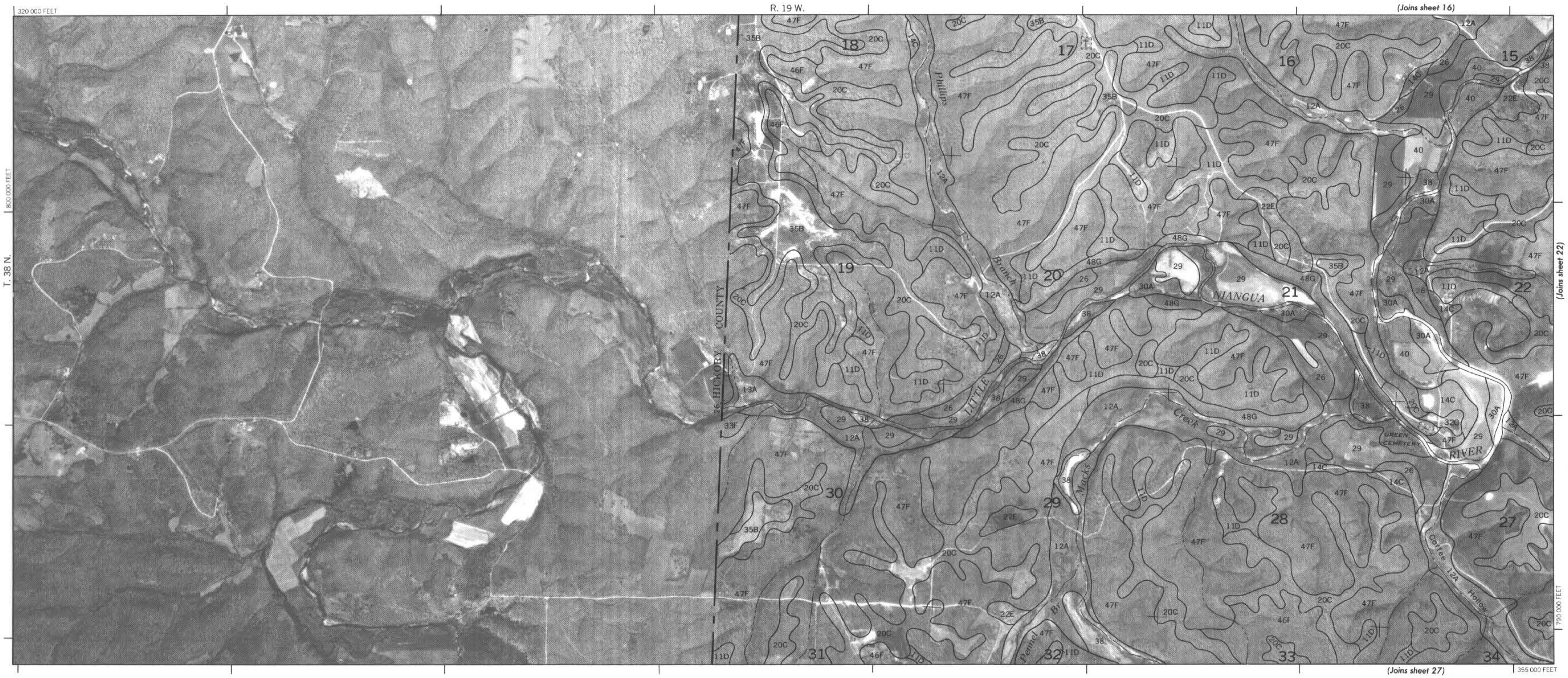

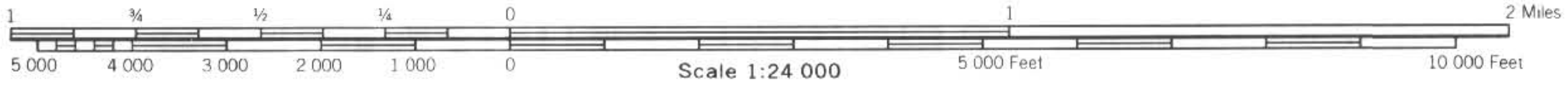

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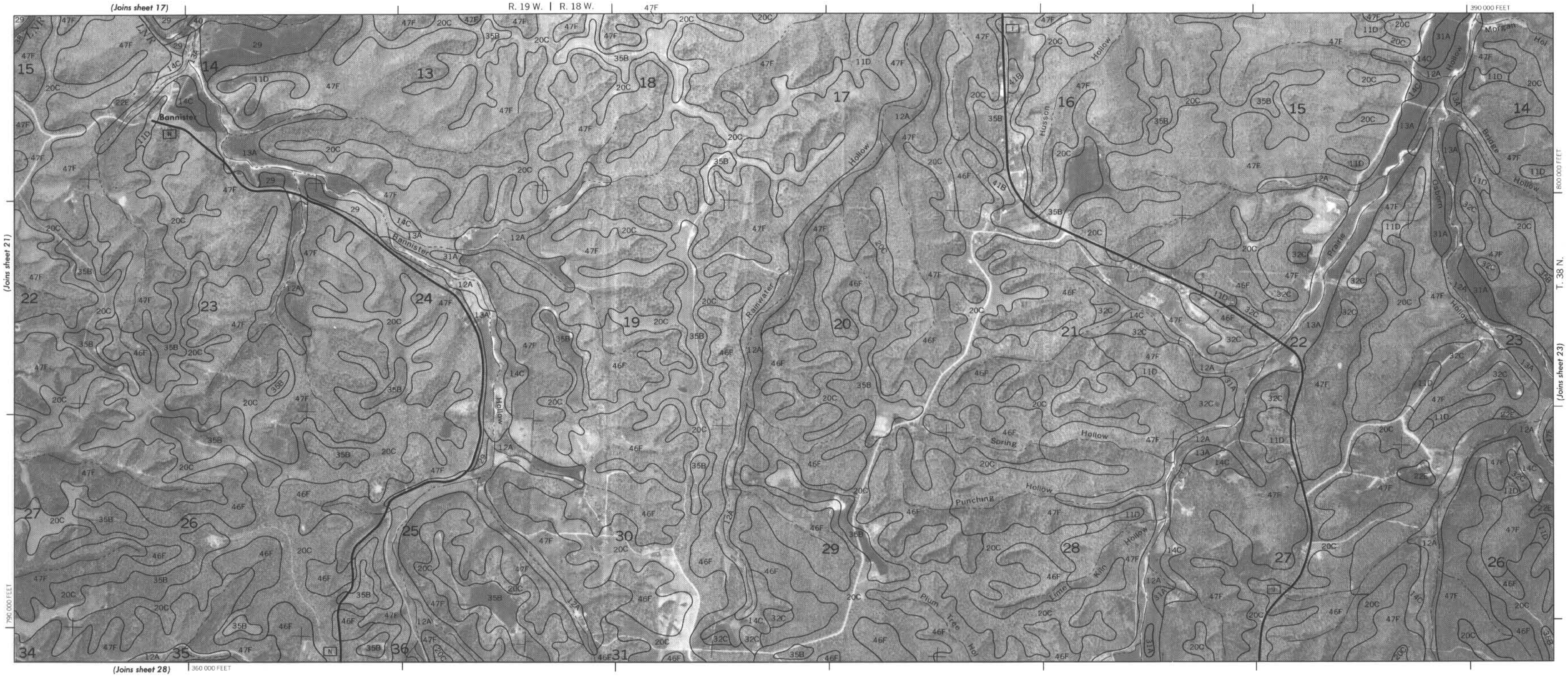

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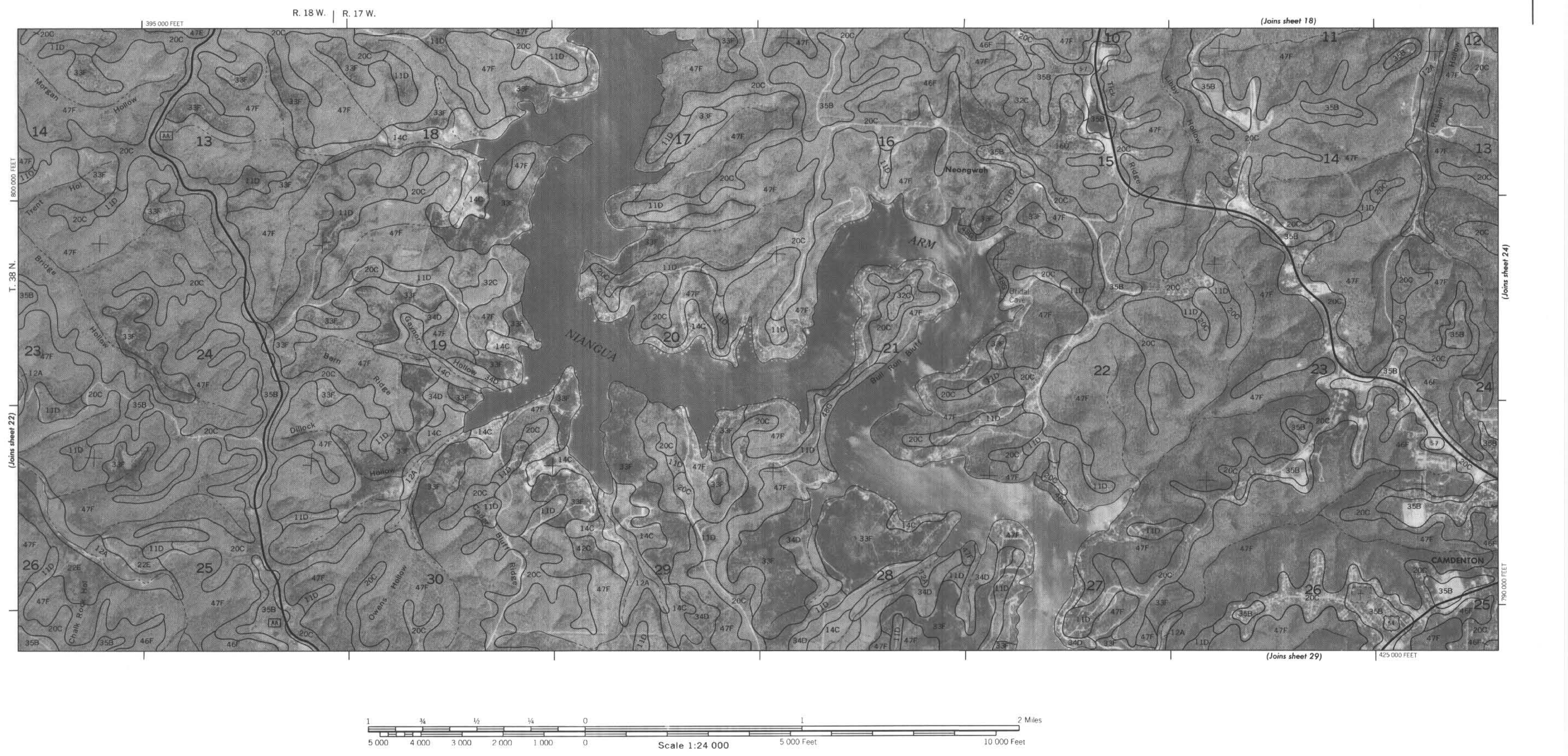

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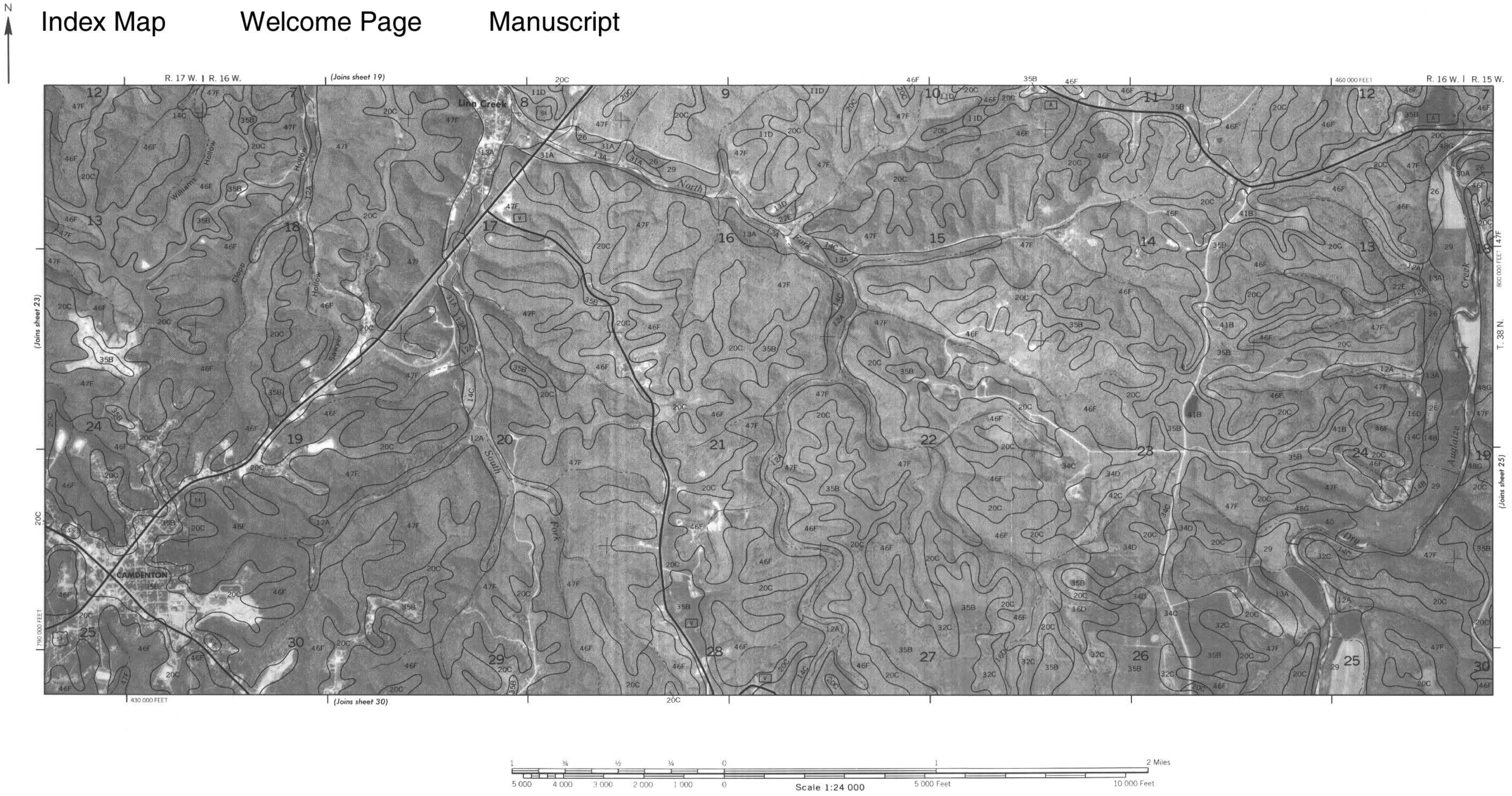

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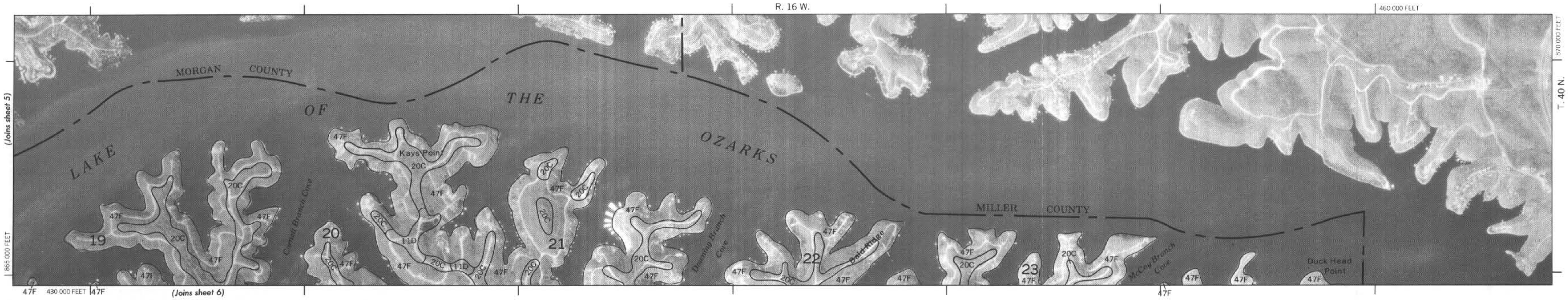

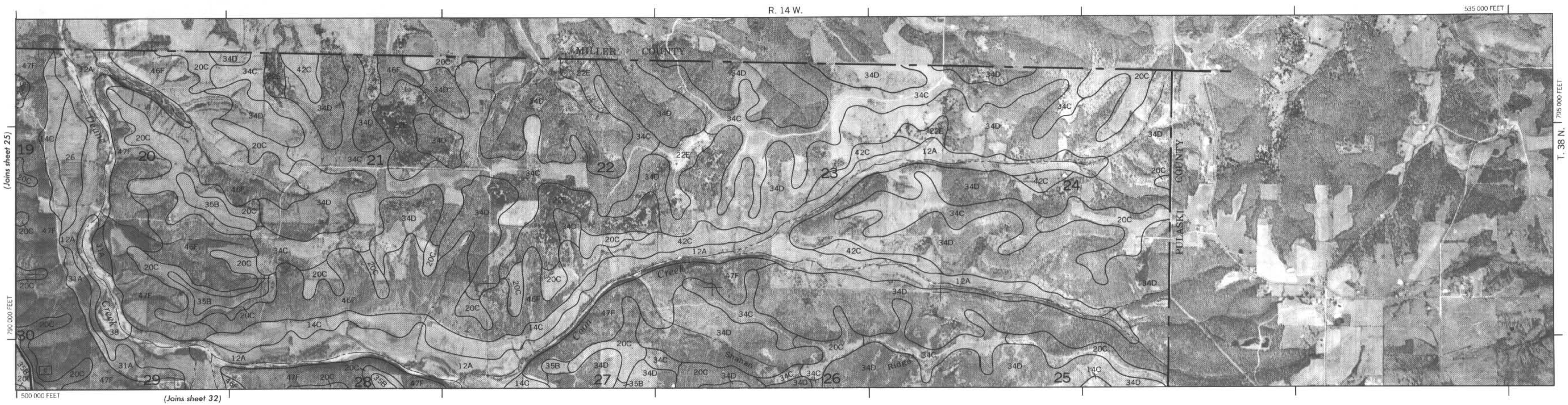

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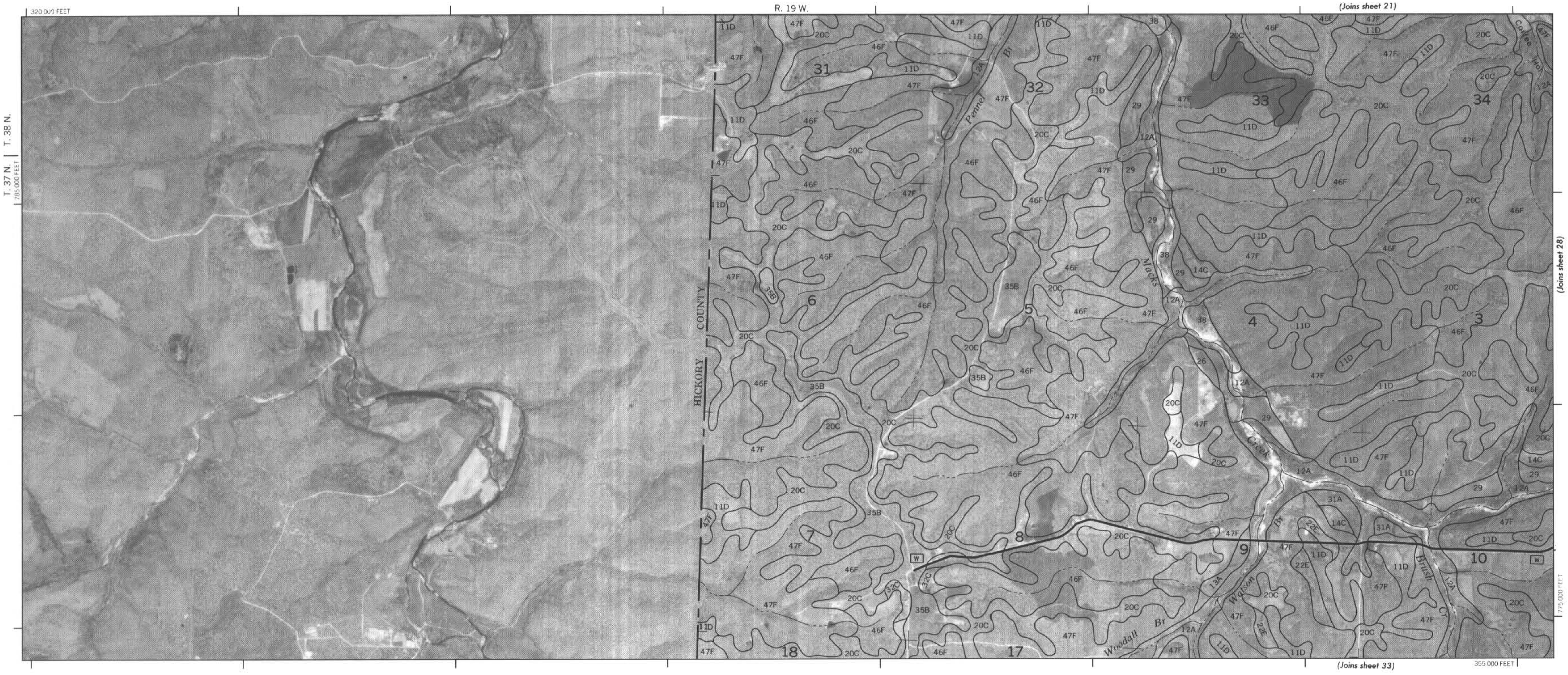

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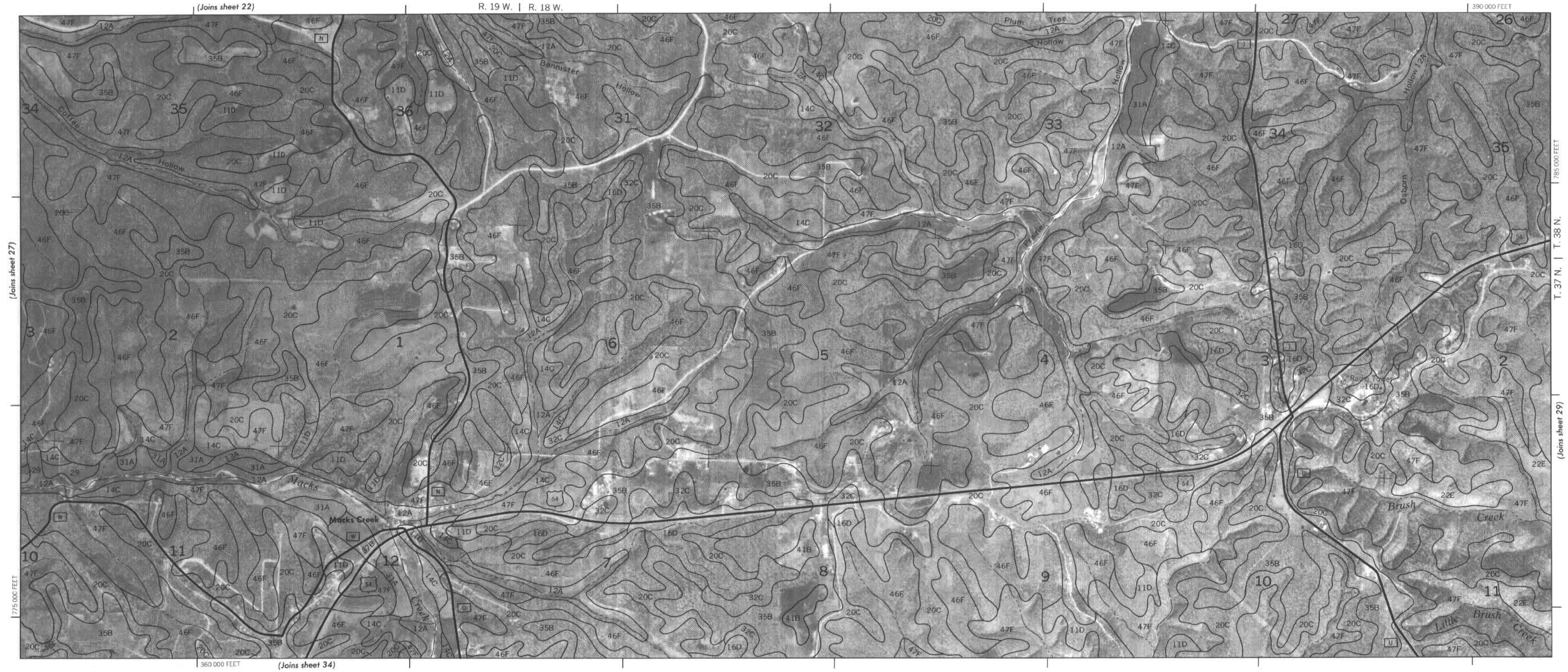

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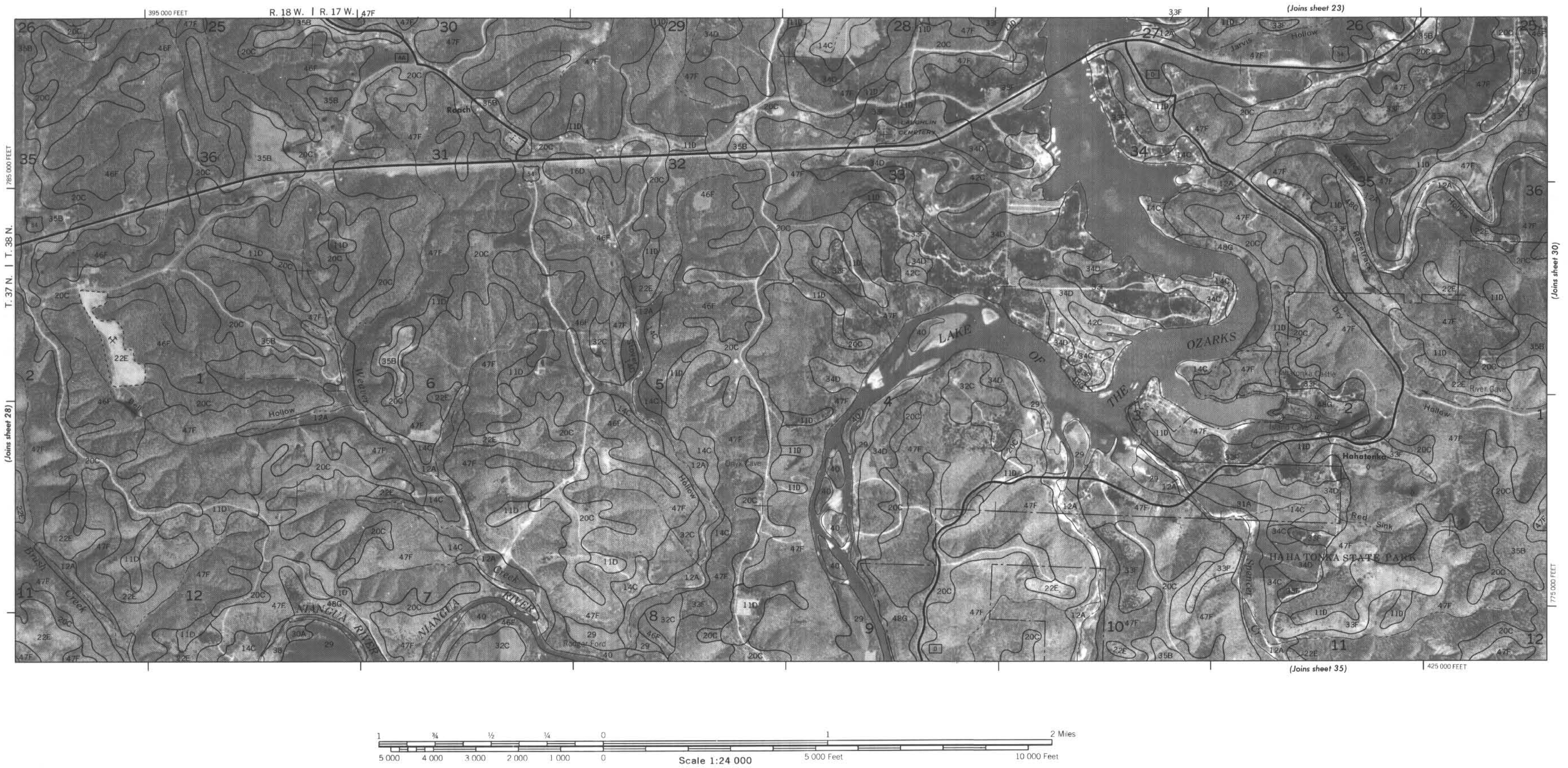

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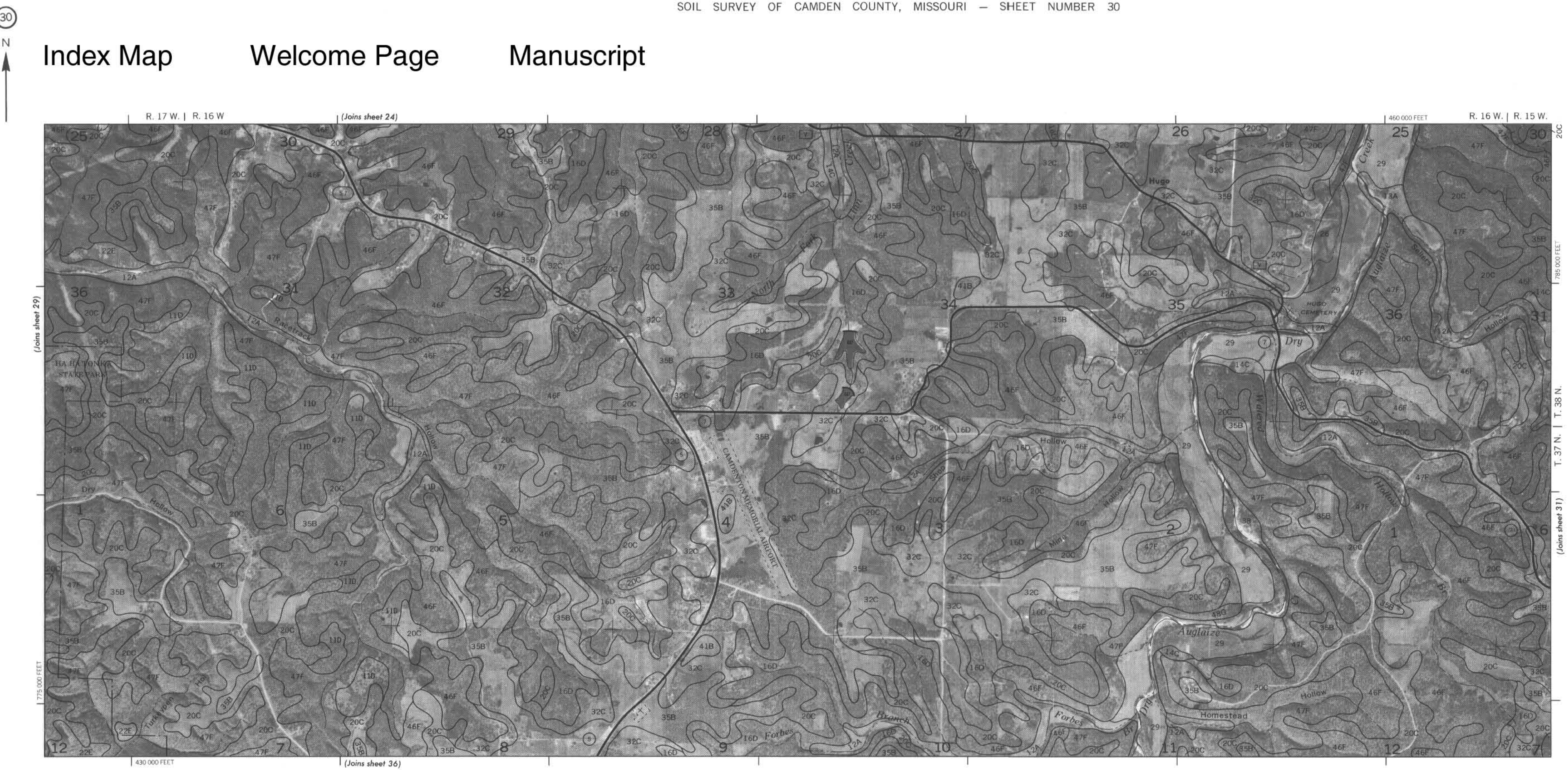

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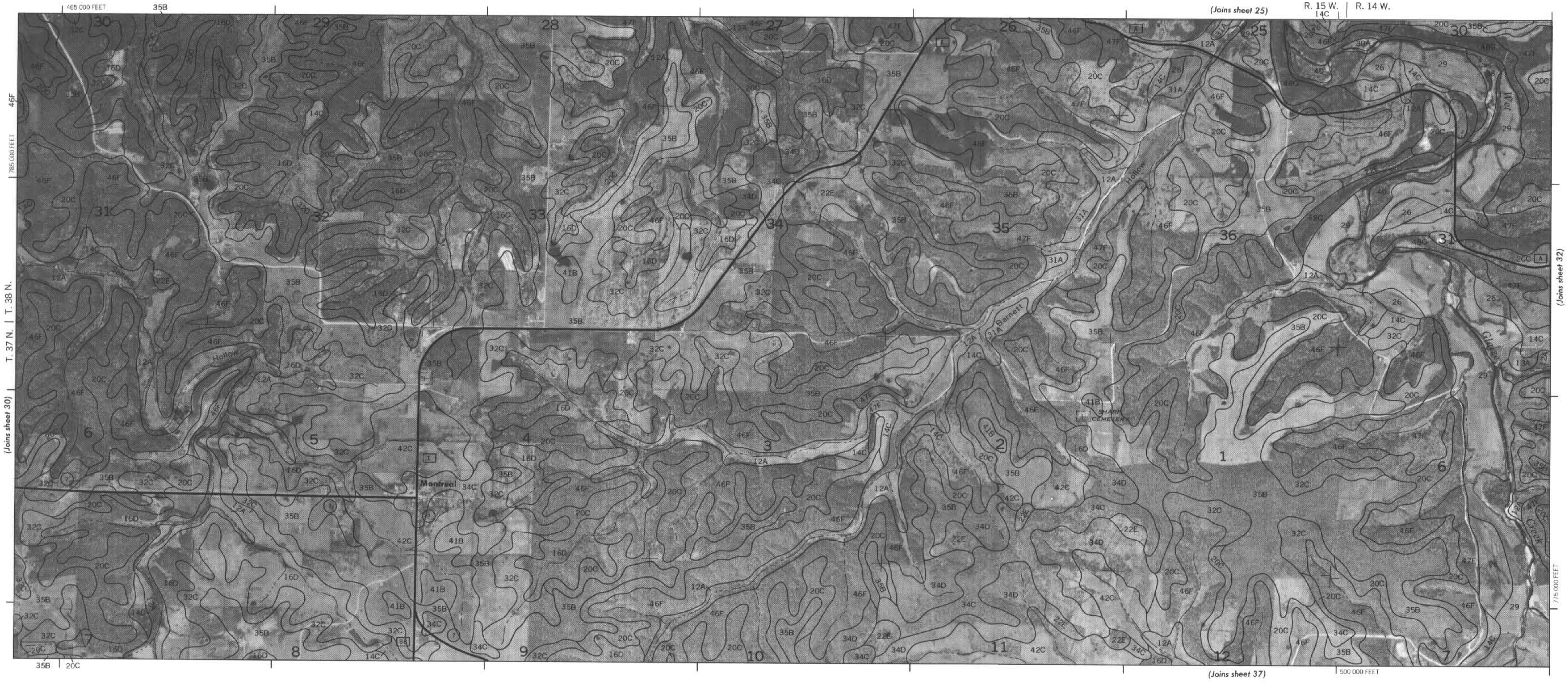

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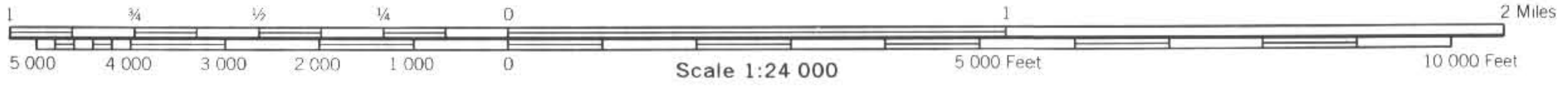

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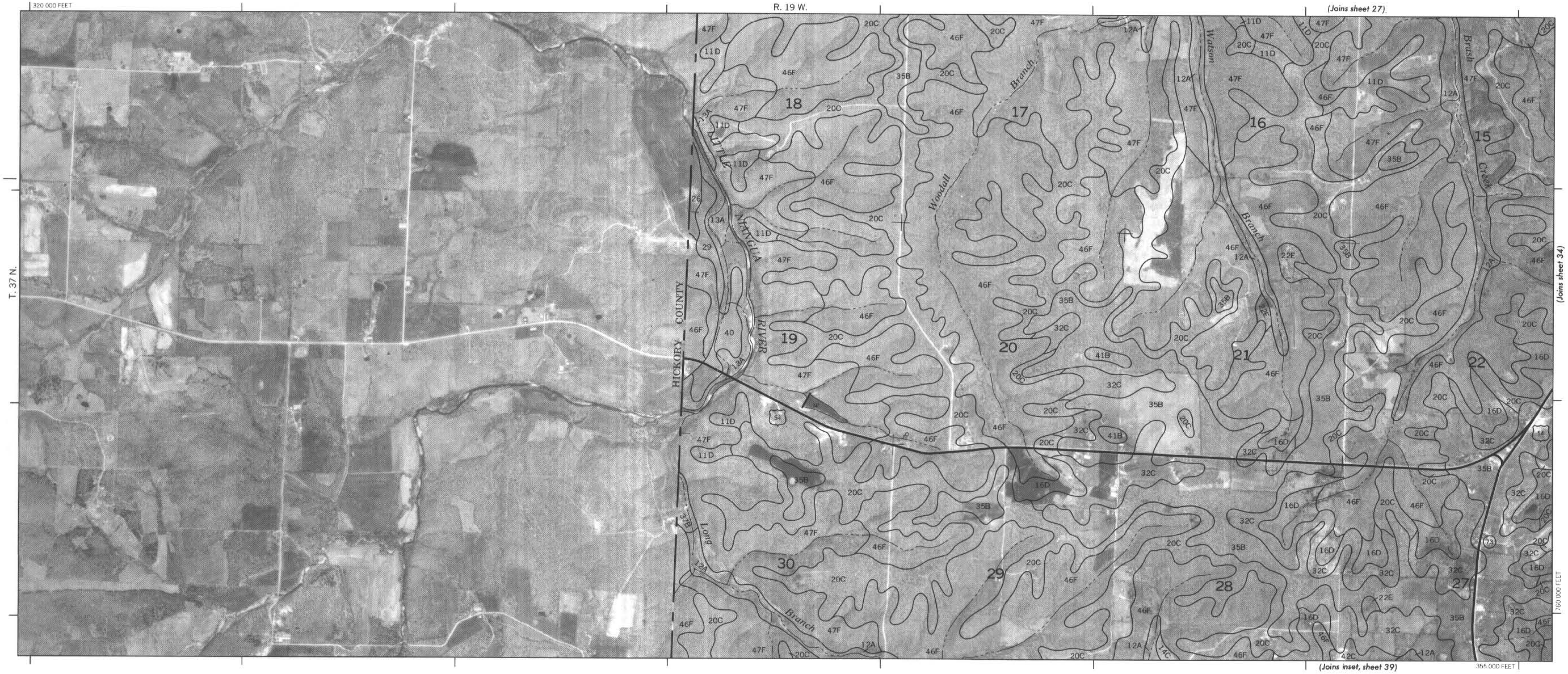

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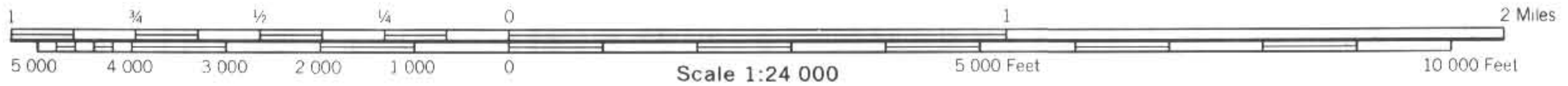

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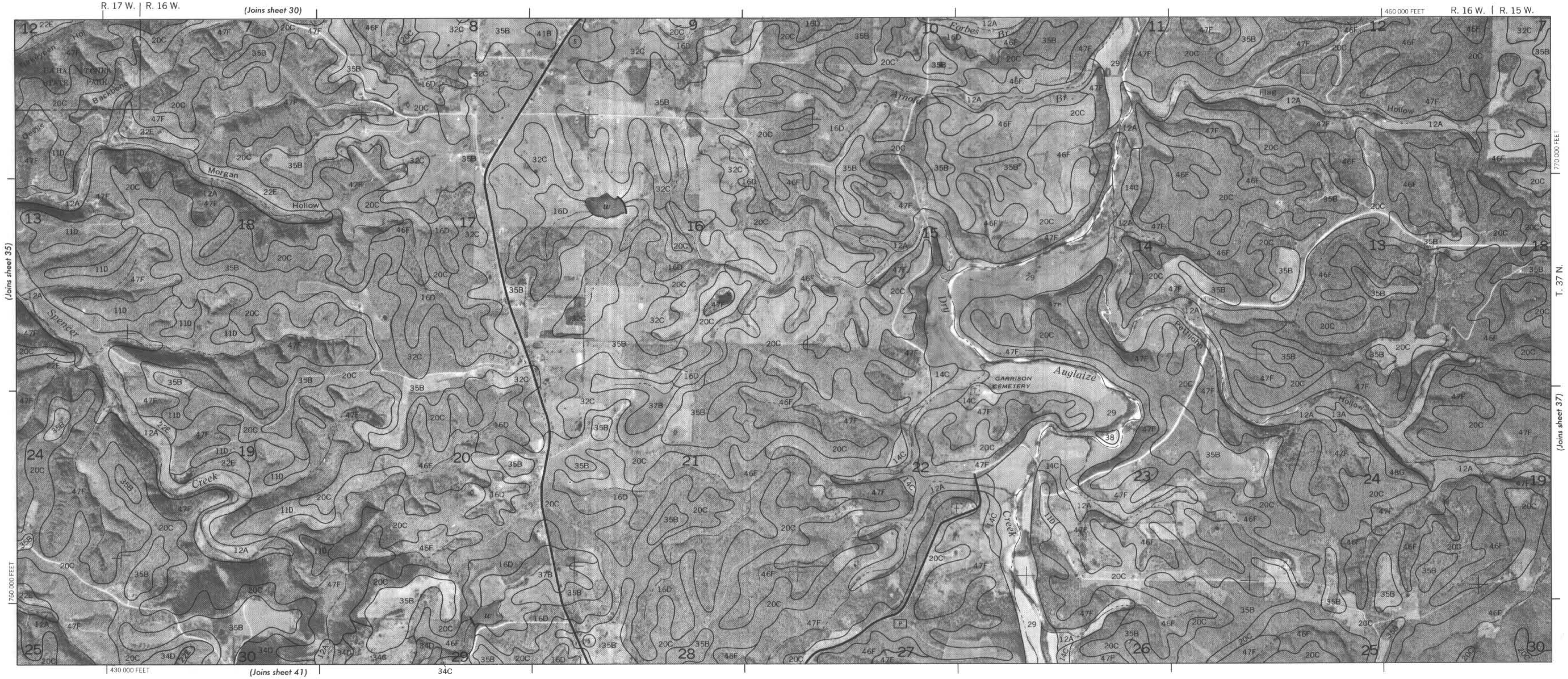

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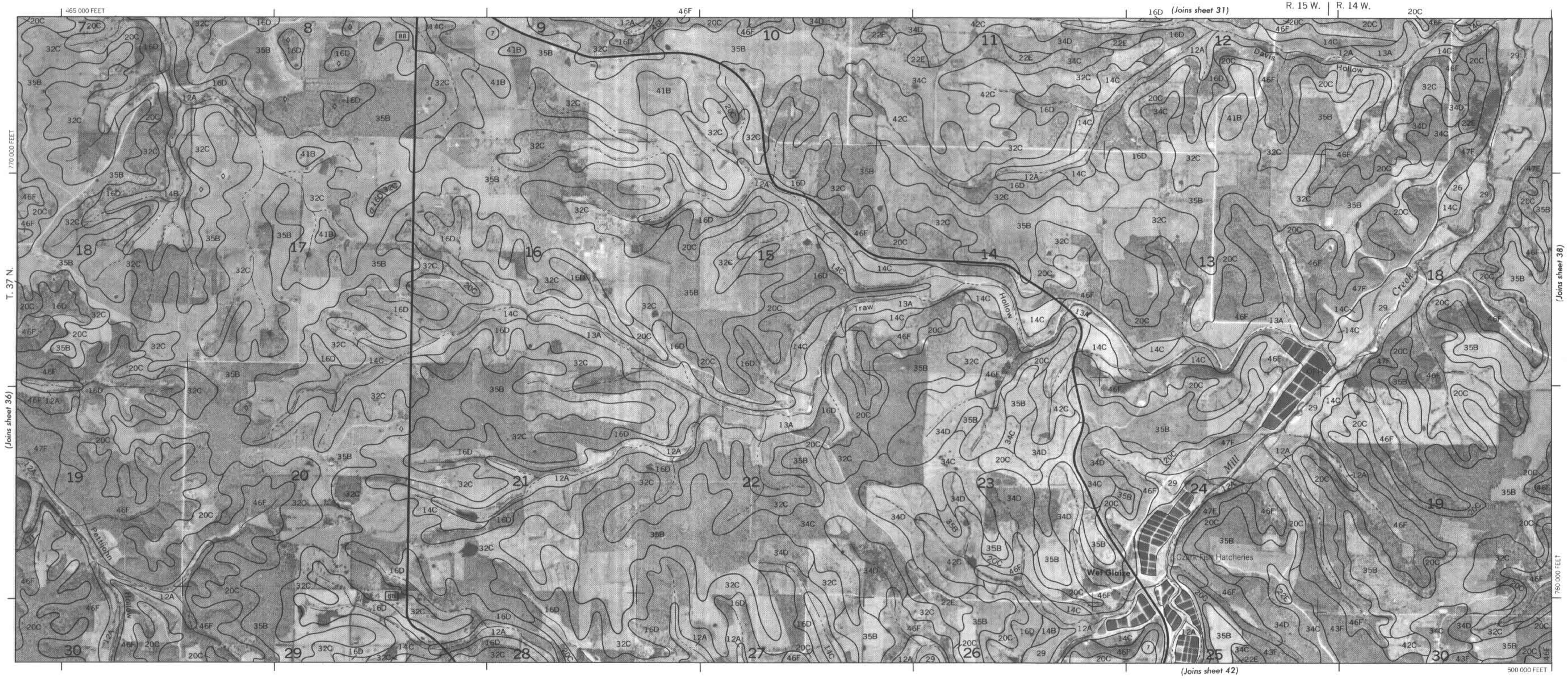

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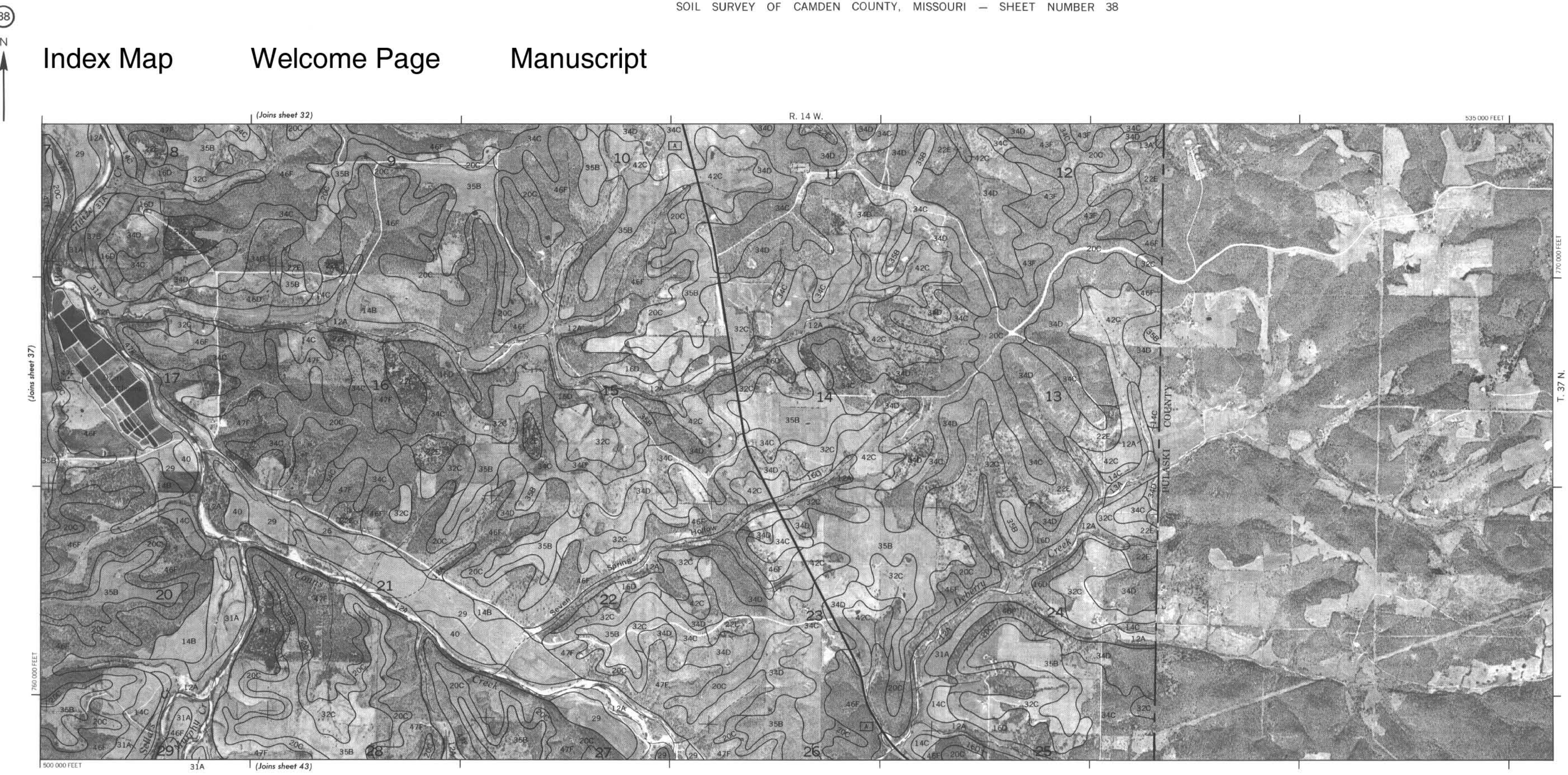

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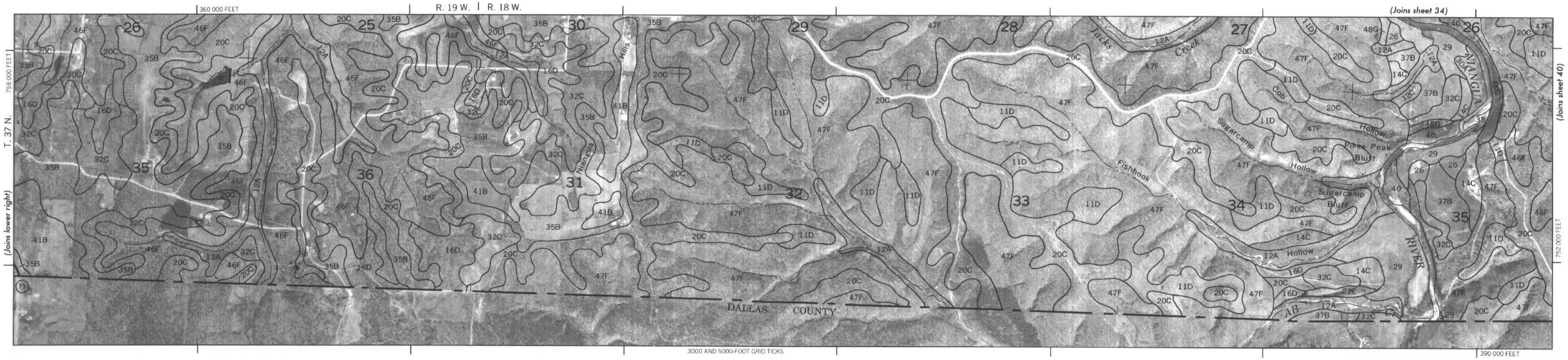

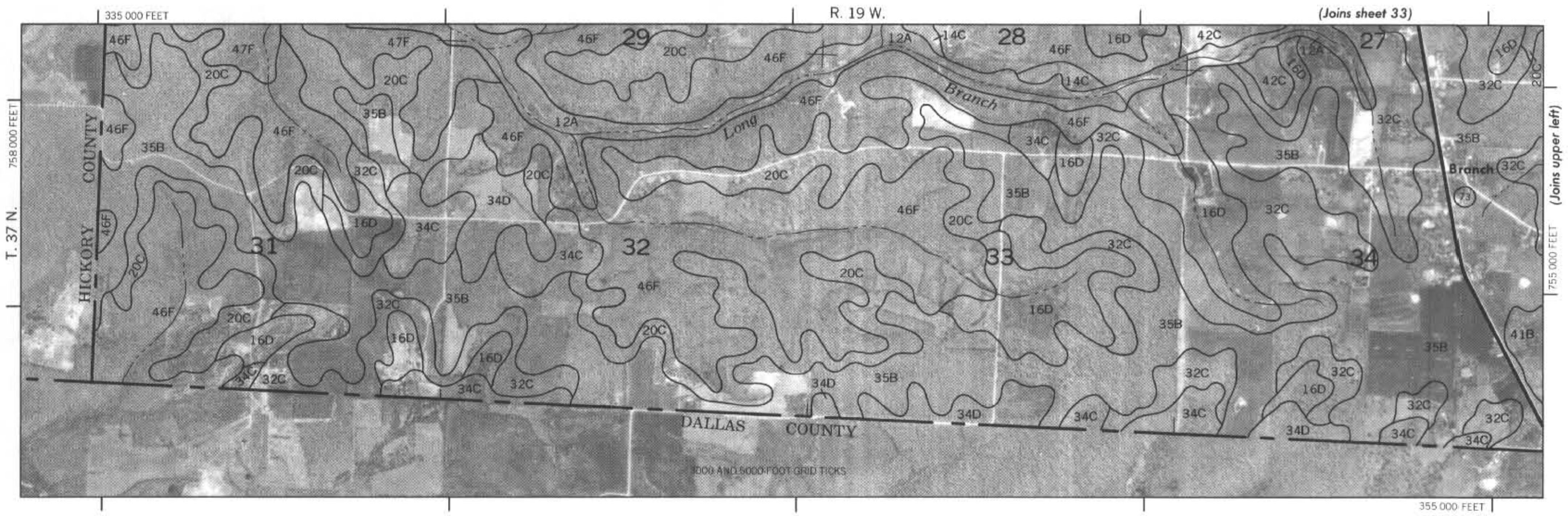

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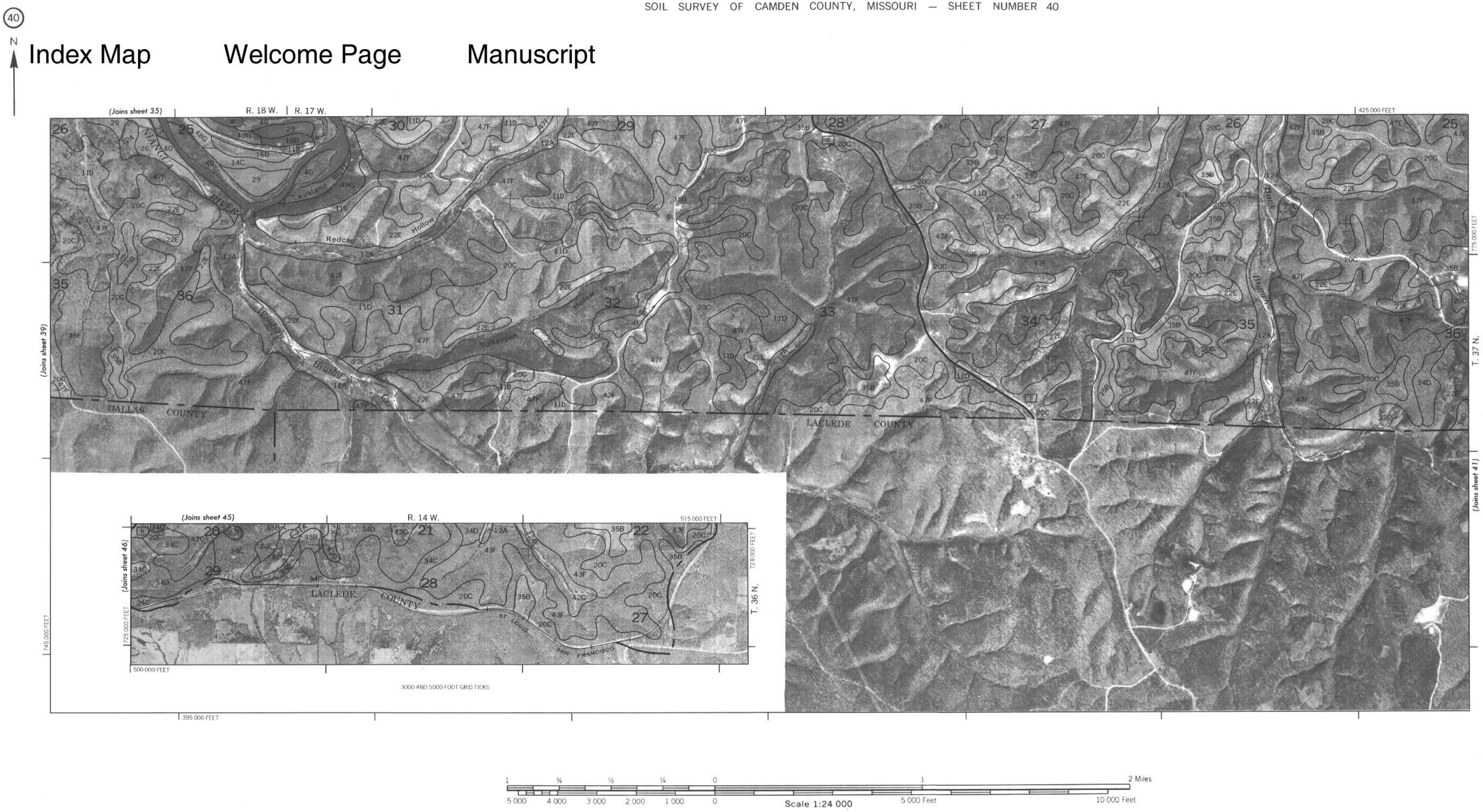

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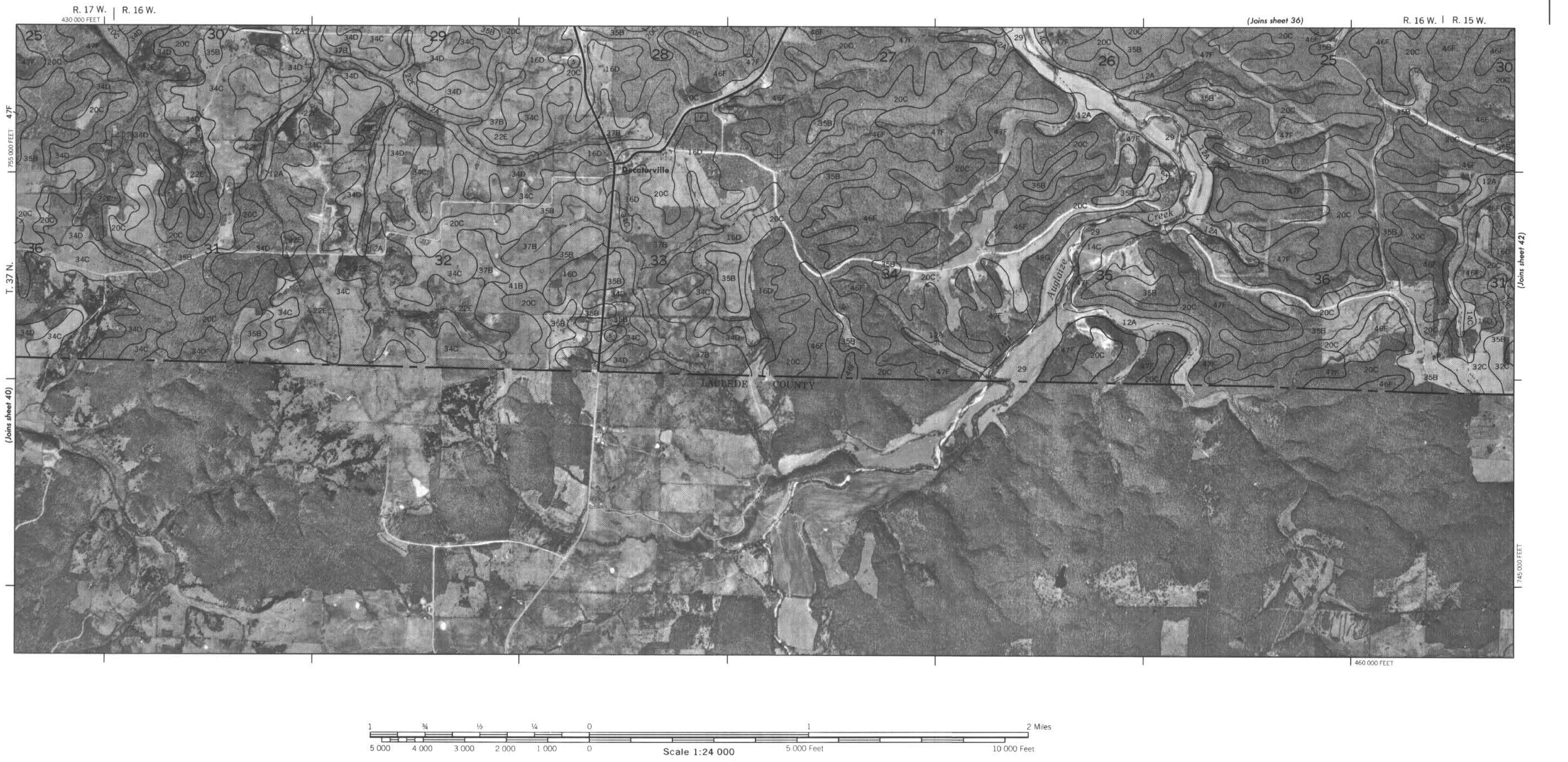

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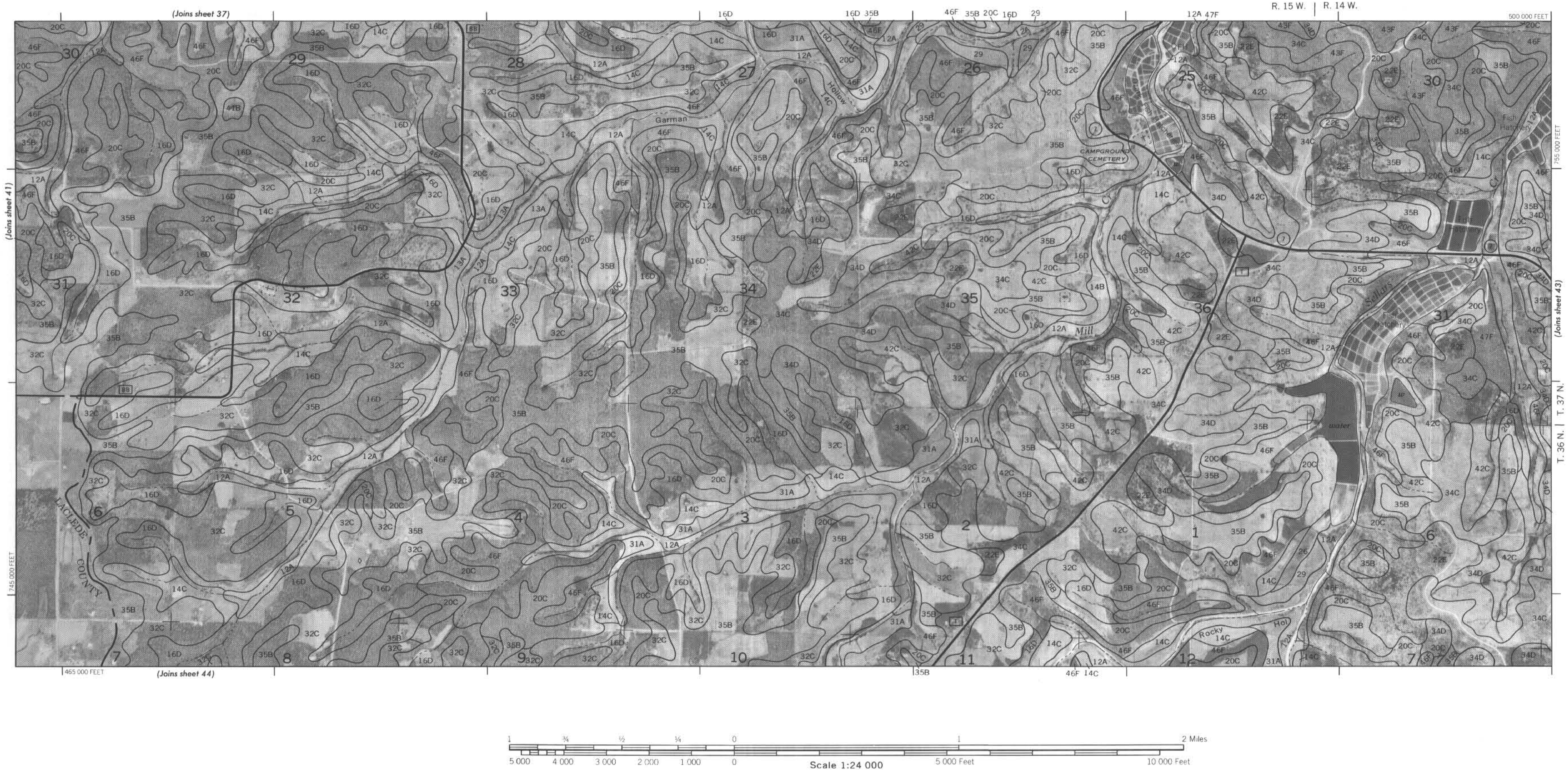

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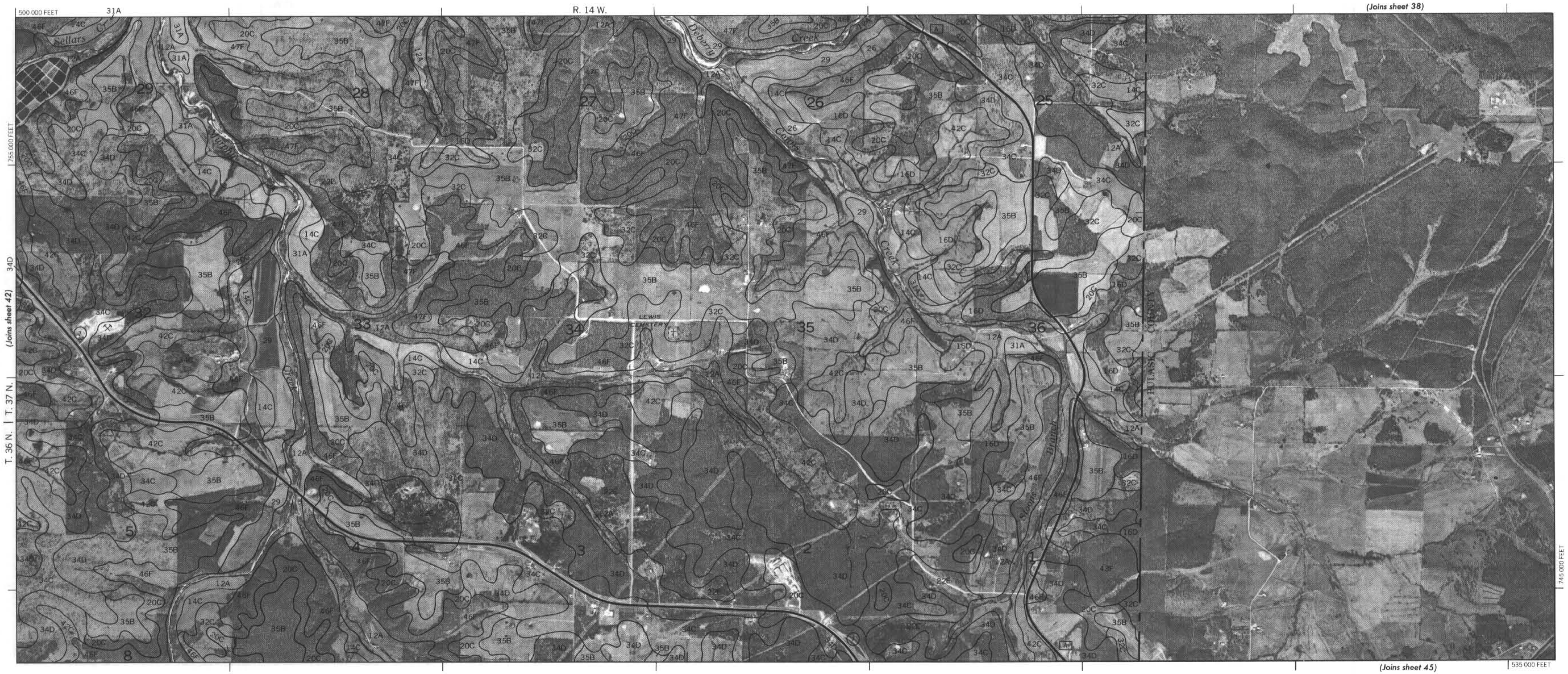

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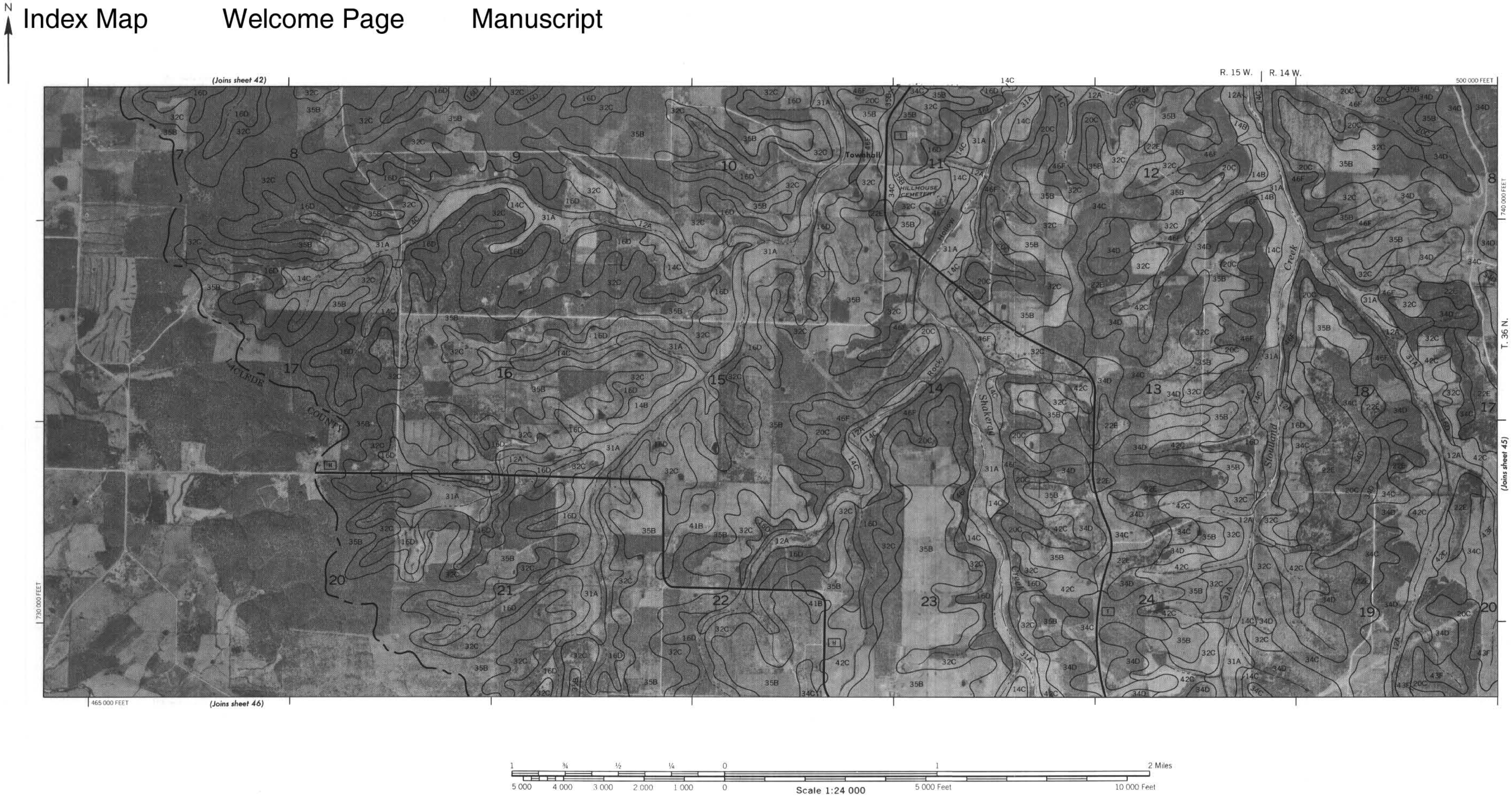

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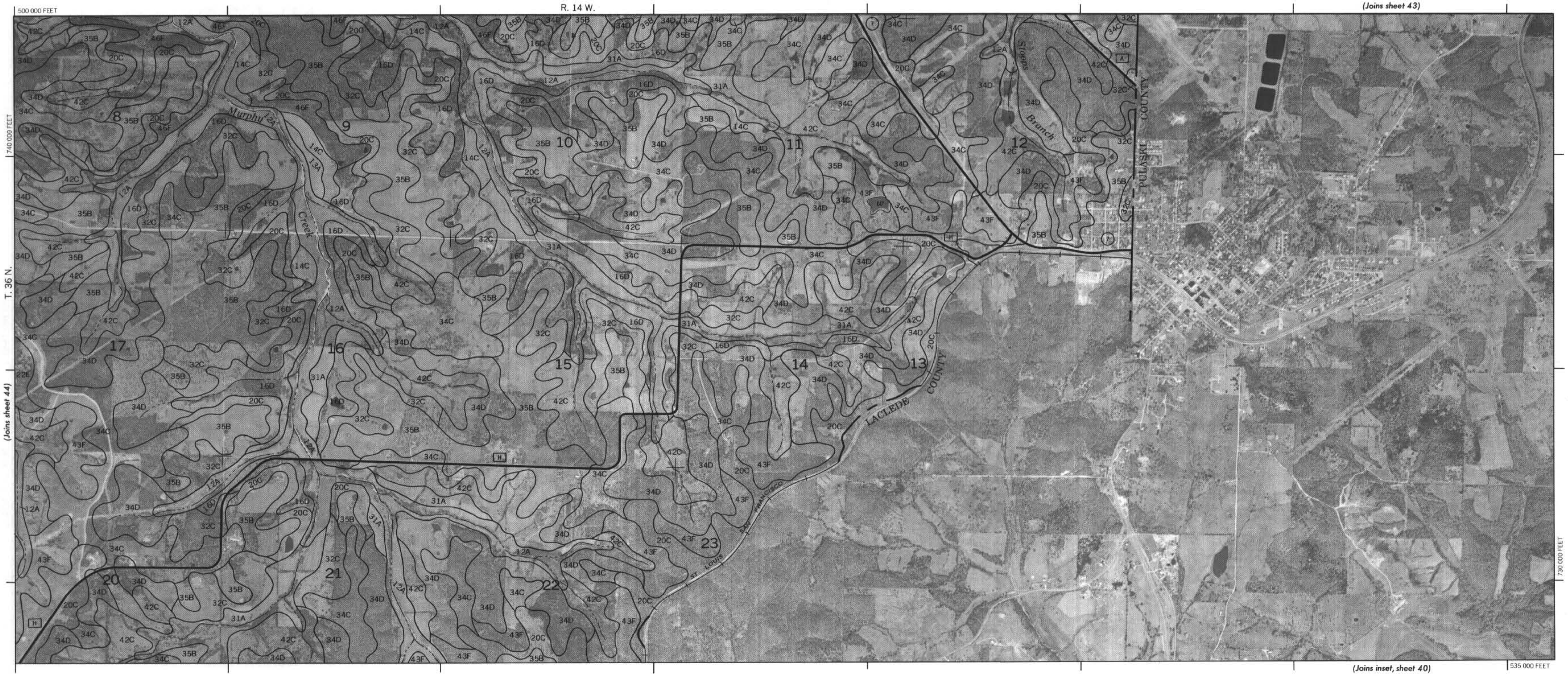

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